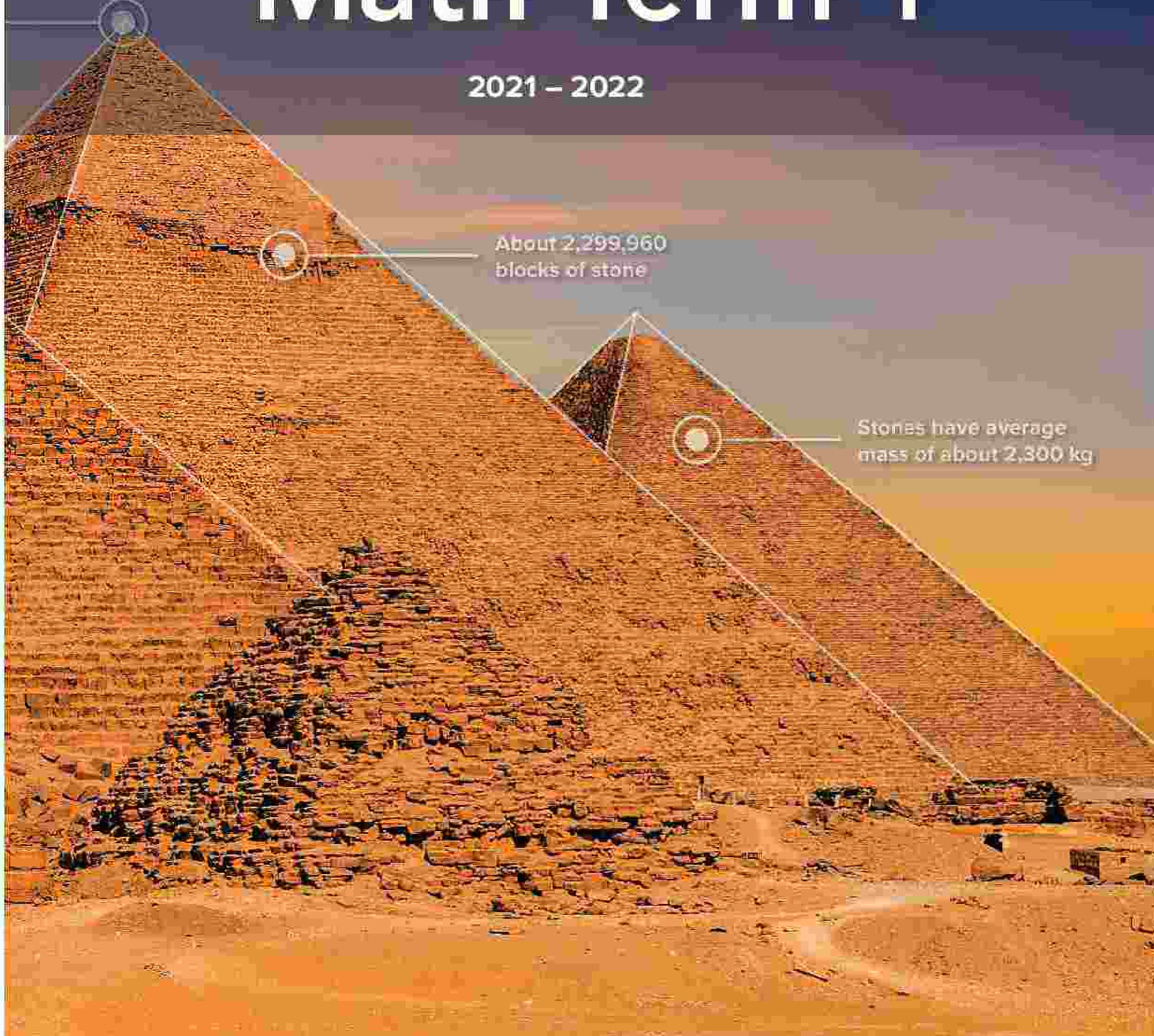
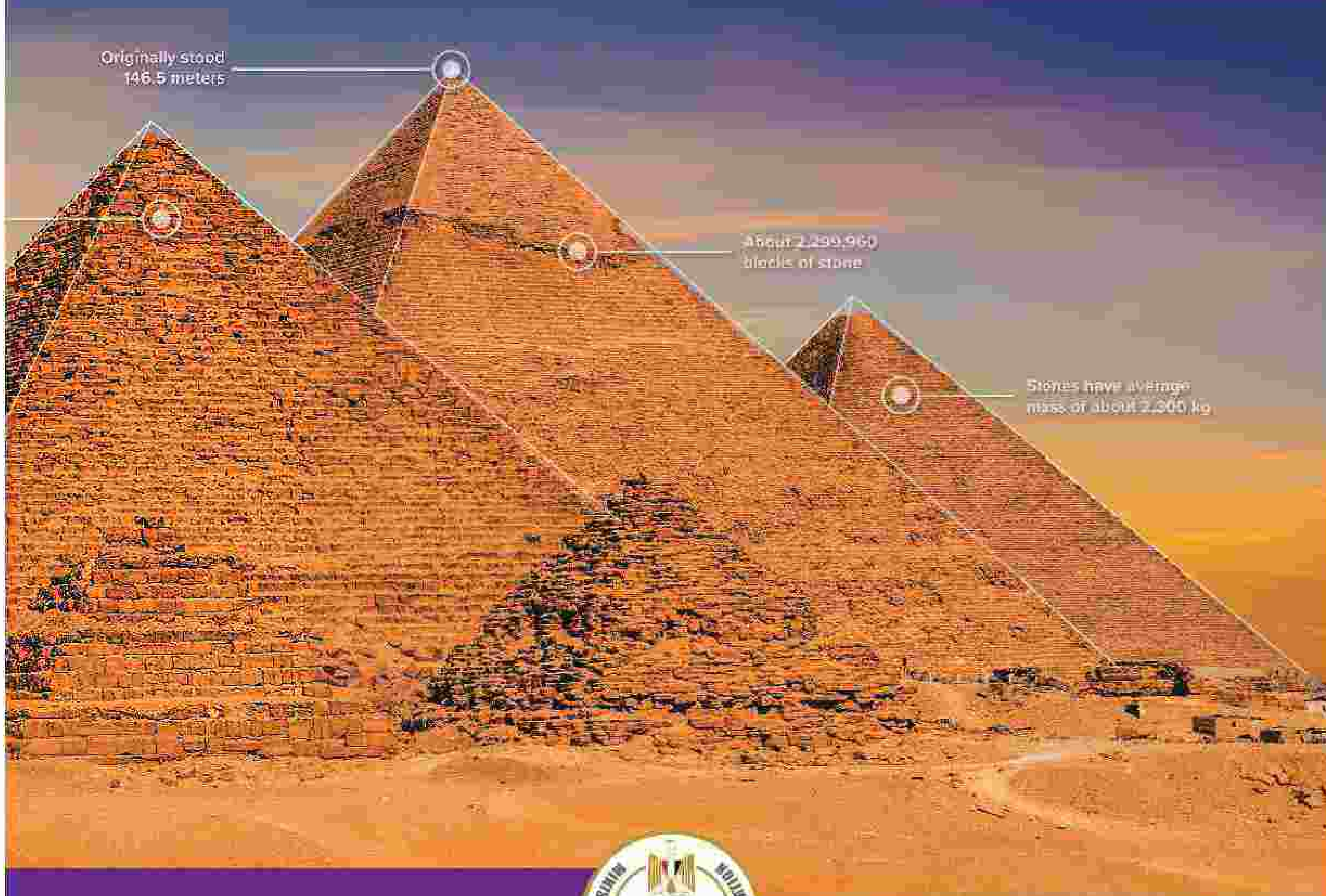
Primary 4
Teacher Edition

Math Term 1

2021 – 2022



Primary 4
Teacher Edition



Math Term 1

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FOREWORD

This is a pivotal time in the history of the Ministry of Education and Technical Education (MOETE) in Egypt. We are embarking on the transformation of Egypt's K-12 education system. We started in September 2018 with the rollout of KG1, KG2 and Primary 1. In 2021 we have rolled out Primary 4, and we will continue with the rollout until 2030. We are transforming the way in which students learn to prepare Egypt's youth to succeed in a future world that we cannot entirely imagine.

MOETE is very proud to present this new series of textbooks, with the accompanying digital learning materials that captures its vision of the transformation journey. This is the result of much consultation, much thought and a lot of work. We have drawn on the best expertise and experience from national and international organizations and education professionals to support us in translating our vision into an innovative national curriculum framework and exciting and inspiring print and digital learning materials.

The MOETE extends its deep appreciation to its own "Center for Curriculum and Instructional Materials Development" (CCIMD) and specifically, the CCIMD Director and her amazing team. MOETE is also very grateful to the minister's senior advisors and to our partners including "Discovery Education," "National Geographic Learning" "Nahdet Masr," "Longman Egypt," UNICEF, UNESCO, and WB, who, collectively, supported the development of Egypt's national curriculum framework. I also thank the Egyptian Faculty of Education professors who participated in reviewing the national curriculum framework. Finally, I thank each and every MOETE administrator in all MOETE sectors as well as the MOETE subject counselors who participated in the process.

This transformation of Egypt's education system would not have been possible without the significant support of Egypt's current president, His Excellency President Abdel Fattah el-Sisi. Overhauling the education system is part of the president's vision of 'rebuilding the Egyptian citizen' and it is closely coordinated with the ministries of Higher Education & Scientific Research, Culture, and Youth & Sports. Education 2.0 is only a part in a bigger national effort to propel Egypt to the ranks of developed countries and to ensure a great future to all of its citizens.

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Words from the Minister of Education & Technical Education

It is my great pleasure to celebrate this extraordinary moment in the history of Egypt where we continue to launch a new education system designed to prepare a new Egyptian citizen proud of his Egyptian, Arab and African roots — a new citizen who is innovative, a critical thinker, able to understand and accept differences, competent in knowledge and life skills, able to learn for life and able to compete globally.

Egypt chose to invest in its new generations through building a transformative and modern education system consistent with international quality benchmarks. The new education system is designed to help our children and grandchildren enjoy a better future and to propel Egypt to the ranks of advanced countries in the near future.

The fulfillment of the Egyptian dream of transformation is indeed a joint responsibility among all of us; governmental institutions, parents, civil society, private sector and media. Here, I would like to acknowledge the critical role of our beloved teachers who are the role models for our children and who are the cornerstone of the intended transformation.

I ask everyone of us to join hands towards this noble goal of transforming Egypt through education in order to restore Egyptian excellence, leadership and great civilization.

My warmest regards to our children who will begin this journey and my deepest respect and gratitude to our great teachers.

Dr. Tarek Galal Shawki

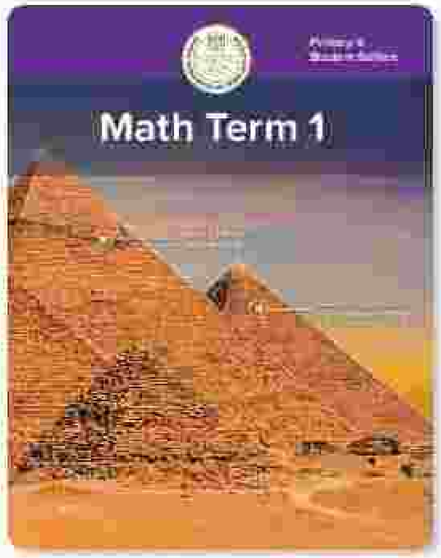
Minister of Education & Technical Education

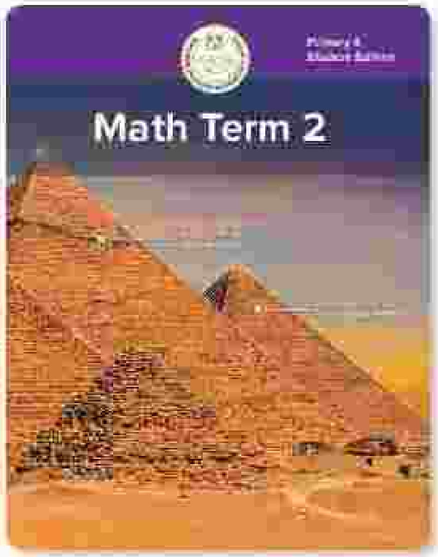
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Welcome to Primary 4 Mathematics Techbook!

Mathematics is everywhere around us. Children begin investigating mathematical concepts at a very early age. In fact, researchers say babies can visually differentiate between different quantities, demonstrating budding numeracy as early as 6 months of age. Children get their first math education at home as they count, make one-to-one correspondence between ordinal numbers and objects, compare quantities, manipulate 2- and 3-dimensional shapes, solve puzzles, look at clocks and watches, play with money, and visit markets in their communities. Mathematics helps children make sense of the world around them. All children are capable of building deep conceptual understanding and procedural fluency in mathematics. This program seeks to support students' development as they learn to reason mathematically, communicate using appropriate mathematical language, solve complex problems, and work collaboratively with peers. As you read the new Primary 4 student and teacher instructional resources, keep a few things in mind:

- The Primary 1 through Primary 3 mathematics curriculum, implemented across Egypt starting from 2018 to 2020, helped lay a foundation for young students to solve complex mathematical problems, persevere in the face of challenging math content, and think and act like mathematicians.
- The Primary 4 mathematics content is more challenging than ever before. However students are aided by their experience in the new KG through Primary 3 curriculum. To help all students reach the challenging expectations in Prep and Secondary, Primary 4 Mathematics Techbook offers opportunities for student to build procedural fluency, make sense of real-world problems, model their thinking and problem-solving strategies, communicate their reasoning, make connections between prior learning and new concepts, and identify patterns and rules that promote number sense and make computation more efficient.
- The Primary 4 math curriculum is called a Techbook™. The Techbook is more than just print. It is a 21st-century instructional resource designed to inspire and empower all students through digital and print learning. You will find that the program has content in both print and digital locations so that students can learn no matter what access they have to the print book or digital versions.





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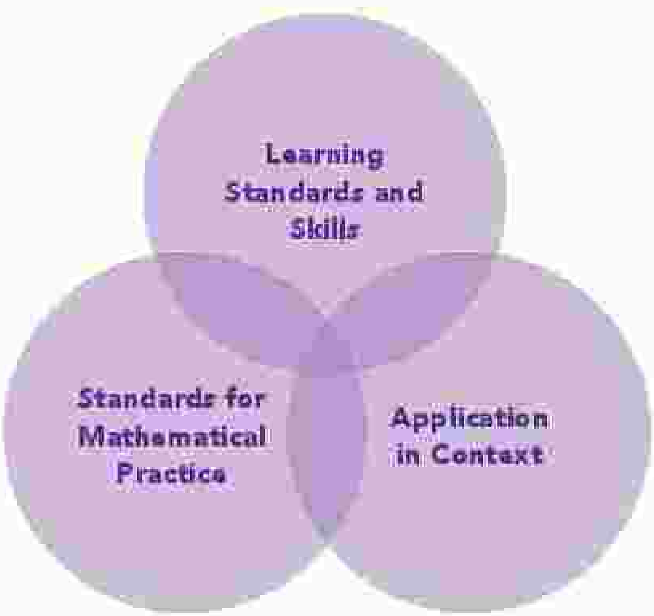
Program Philosophy

The Primary 4 Mathematics Techbook was designed and written to teach to the Ministry of Education Primary 4 Mathematics standards. These standards are internationally benchmarked, providing students in Egypt with a rigorous framework of learning targets.

The first step in building the Primary 4 standards was the adoption of new standards and specific grade-level indicators for learning and applications in number and operations, algebraic thinking, geometry, data collection and analysis, measurement, and fractions and decimals. These standards are integrated across three dimensions:

- Learning standards and skills
- Application in context
- Standards for mathematical practice

This entire approach to teaching mathematics is referred to as three-dimensional learning. The idea is that math is much more than an accumulation of facts; rather, it is an intersection of three dimensions: mathematical skills and concepts, problem solving, and engaging in practices that support mathematical thinking and reasoning.



The intersection of these three dimensions provides the foundation for the mathematics content in Primary 4. The structure of Primary 4 Mathematics Techbook also embodies the Ministry's shifts in the Framework for Education 2.0., specifically focusing on the following:

- accessing new and prior knowledge;
- building contextual understanding and procedural fluency; and
- making connections across mathematics domains to support application of skills and concepts.

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Program Overview

Globally Prepared Students: Mathematics in Context



To help students make sense of mathematical content and to help students understand the role of mathematics in our lives, Primary 4 Mathematics Techbook integrates a thematic approach to help students understand and apply mathematics in a variety of real-world scenarios.

Engaging, Hands-On Learning: All Students as Mathematicians

Hands-On Activities (HOAs) are a central component of Primary 4 Mathematics Techbook. Hands-On Activities require students to investigate patterns and rules in mathematics; build mathematical understanding through observation, collaboration, and problem solving; communicate using mathematical language and models.

A materials list for each HOA is included in multiple locations: at point-of-use in digital and in the print Teacher Edition, both at front-of-concept and at point-of-use. Mathematics materials have been chosen to be easily accessible and mostly familiar to both students and teachers. Options are given for commercially available manipulatives and paper-based versions of those manipulatives. Each materials list should be reviewed well in advance of the date of classroom use to ensure all materials are available or prepared.

> “Thinking Like a Mathematician”

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Reading, Writing, Speaking, and Listening in Mathematics

Reading, Writing, and Mathematics

Writing is an important part of mathematics because it is how real mathematicians document and communicate their ideas, activities, and conclusions to others. Primary 4 Mathematics Techbook engages students in many kinds of writing, particularly in Writing About Math tasks, which often ask students to explain their reasoning and support their thinking using words, numbers, pictures, and symbols.

Informational texts throughout Techbook help students strengthen their reading comprehension skills while providing context for learning. Primary 4 Mathematics Techbook also expects students to use speaking and listening skills to demonstrate their understanding and application of mathematics skills and concepts. Both the digital and the print resources will engage students in the practice of this type of writing, speaking, and listening.

Building Mathematical Language of All Students

Reading and writing success in mathematics depends on the ability of students to understand not only the definition of vocabulary words, but also how the academic language connects ideas, adds details, or helps them accurately express their learning, thinking, and reasoning. Academic language is supported and emphasized through strategies for learning vocabulary, frequent vocabulary used in various contexts, and formative assessment items.

Student-Centered Learning and the A-B-C Instructional Framework

When one gear moves, they all move. All components of a lesson are dependent on one another and are not entirely linear. Students continue to access knowledge as they build understanding. They make connections as they access knowledge. They build understanding and reasoning as they connect ideas. When students engage in rich tasks that access prior knowledge and build reasoning, it is easier for them to efficiently and effectively make connections to the real world and to other mathematica learning.

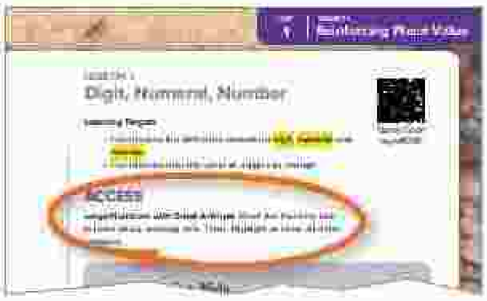
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A-B-C Instructional Framework

Lessons within the A-B-C Instructional framework are structured as follows:



ACCESS (5-10 minutes)



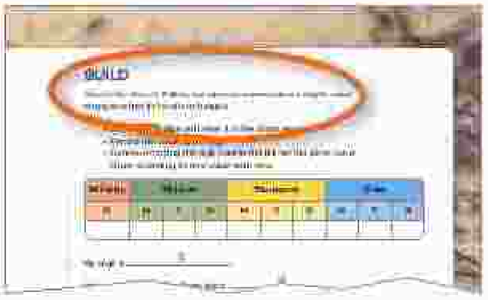
Provides opportunities for:

- Engaging learners, leveraging prior knowledge, sparking interest
- Facilitating mathematical conversations to build connections
- Supporting various ways learners make their understandings visible

Focus: Developing and expressing mathematical language

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BUILD (35-40 minutes)

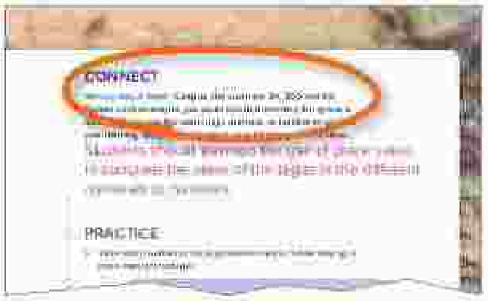


Provides opportunities for:

- Developing fluencies with graduated levels of support
- Questioning, responding, and giving suggestions to support learning
- Reflecting on mistakes and misconceptions to improve understanding

Focus: Communicating about understanding, reasoning, evidence, strategies, and lingering questions

CONNECT (5-7 minutes)



Provides opportunities for:

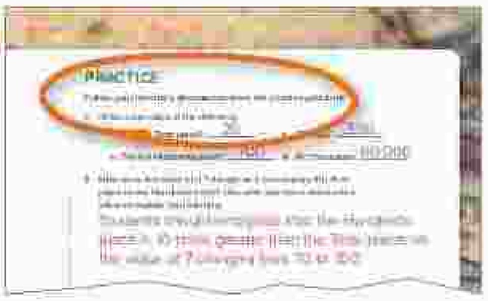
- Connecting learner-generated strategies to procedures
- Engaging in challenging tasks that allow learners to transfer knowledge to new situations
- Identifying, expressing, and applying critical connections between and among mathematical skills and concepts

Focus: Building ability to communicate deep conceptual understanding and to ask meaningful questions to challenge misconceptions

WRAP-UP (3-5 minutes)

- Students express verbally or in writing what they "connected" and learned.

PRACTICE



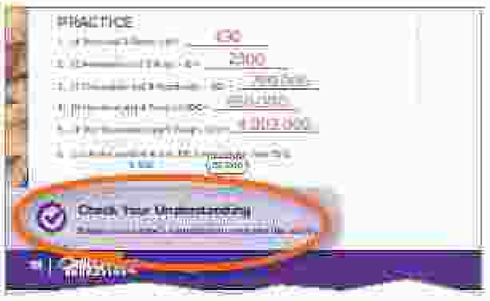
- Helps teachers make decisions about instructional grouping and differentiation.
- Up to 5 varied practice problems that allow students to demonstrate learning

Flexible use:

- Could be done with whole group, in small groups with or without the teacher, or independently (at the teacher's discretion)
- Could be part of remediation
- Could be an extension of the Wrap-Up discussion
- Lives in the Student Edition (print and digital)

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Check Your Understanding



- All lessons include a Check Your Understanding (CYU) section that consists of 2–5 practice problems. These problems allow teachers to collect information quickly and effectively about students' learning.
- The section can be assigned for independent practice during small group instruction (while the teacher works with other students) or homework.
- The section can include a little spiral review, but that should not be the focus of the CYU.
- These can be used for a grade.
- The Check Your Understanding problems are available in the digital Student Edition, and provided to the teacher for copying and distribution in the Teacher Edition. Answers to these problems appear within the Teacher Edition at point of use.

Assessment

Each Concept closes with a Concept Check-In and Remediation lesson. The Concept Check-In is a formative assessment that helps the teacher make instructional decisions. The Concept Check-In is accompanied by suggested strategies for addressing students' lingering misconceptions and errors. Concept Check-In and Remediation lessons are available in the digital Teacher Edition. A Unit Assessment is provided at the end of each unit of instruction. This assessment is summative and can be used for a grade.

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Primary Mathematics 4

Course Structure

The Primary 4 Mathematics Techbook is a comprehensive teaching and learning package, featuring an easy-to-use digital platform, an interactive print Student Edition, and a print Teacher Edition. This print Teacher Edition provides guidance for teachers to implement high-quality, three-dimensional learning through Hands-On Activities, exploration of mathematics skills and concepts through models, practice, and application, and print and digital assets. This flexibility of resources supports the many variations of classroom settings, so teachers can implement standards-based lessons no matter their particular situation. The digital and print resources work seamlessly together, allowing students to both express thinking on paper and explore ideas and concepts digitally.



Themes

The Primary 4 Mathematics Techbook is organized into four themes that form the structure of mathematics courses from Primary 4 through Primary 6. In each grade, the theme is studied through an applied topic, represented by units within this curricular resource. The themes and Primary 4 ***units*** are as follows:

Theme	Primary 4 Units
Number Sense and Operations	1 – Place Value 2 – Addition and Subtraction Strategies 3 – Concepts of Measurement 4 – Area and Perimeter
Mathematical Operations and Algebraic Thinking	5 – Multiplication as a Relationship 6 – Understanding Factors and Multiples 7 – Multiplication and Division: Computation and Relationships 8 – Order of Operations
Fractions, Decimals,and Proportional Relationships	9 – Fractions 10 – Decimals 11 – Data with Fractions
Applications of Geometry and Measurement	12 – Geometry 13 – Angles of a Circle/Year-End Review

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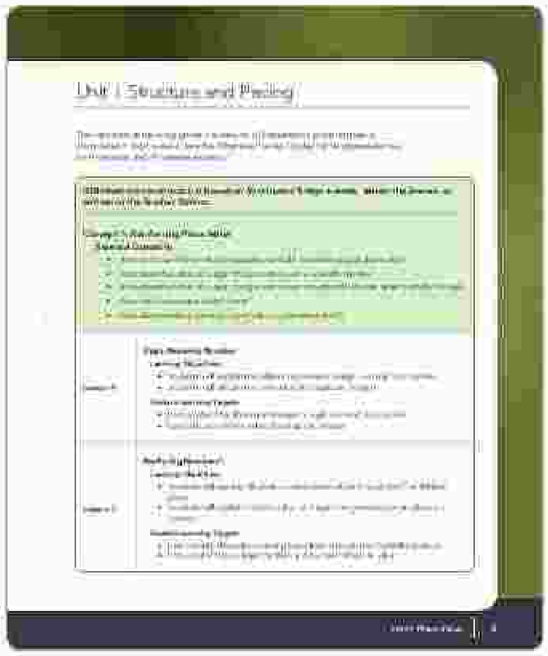
Techbook Overview and Features

Concepts

Units are divided into concepts. These concepts break down the major learning of each unit into chunks of instruction. This conceptual approach helps students make sense of new learning in the context of existing understandings and supports their efforts to make connections across skills and concepts.

Lessons

Each concept is composed of a series of lessons. The Unit Structure and Pacing information clearly outlines the sequence and duration of each lesson for schools with daily, 60-minute mathematics instructional periods. Alternative pacing is provided to support learning environments that teach math in 45-minute or 90-minute blocks of time.



Lessons typically begin with whole group discussion and instruction and may include partner or small-group, split-classroom, or station rotation learning activities.

- **Whole Group:** Provides an opportunity to bring students together as one whole group to introduce a new concept, engage in rich discussion-based or inquiry-based instruction, or address similar gaps in knowledge and provide instruction to address needs. Whole-class strategies can include Math Talk, Math Language Routines, discussion, teacher demonstrations, and giving directions.
- **Partner or Small Group:** Allows students to support one another's learning during whole group activities.
- **Split Classroom:** Allows teacher to focus on a topic or skill with up to half of the students in class, while the other half works independently or with a co-teacher.
- **Station Rotation:** Allows students to rotate through stations on a fixed schedule. One of the stations is typically teacher-led, while others can be independent or working with partner(s).

Review Lessons

Throughout the instructional materials, there are several lessons marked as Review lessons. These lessons are designed to help students recall and apply important skills and concepts they learned in Primary 3 before they move on to more challenging Primary 4 content. These lessons can be used with a small group or with the whole class, as needed. If students do not require a Review lesson before moving on to Primary 4 content, Review lessons can be skipped, and instruction can continue with the next lesson.

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Tools and Text Features

The tools within every concept in Primary 4 Mathematics Techbook support differentiation for lessons and cater to the different learning preferences of diverse learners. In the digital core interactive text, students and teachers can have text read aloud, highlight important information, or annotate content with sticky notes. Select the text for any concept, and a reader tool will appear.



Digital Teacher Materials

In digital Primary 4 Mathematics Techbook, teachers can not only easily see the student view of content, but they can also access additional support using the Teacher Presentation Mode toggle. Teacher notes, including both the instructional focus and recommended strategy, are included with each activity and are visible to teachers only. In addition, teachers can view sample responses and detailed procedural notes.

Flexible Learning Environment

With the evolution of technology, today's students expect information to be available differently than previous generations of students. Students are accessing information in shorter segments, streaming digital shows, and reading posts through social media. The Primary 4 Mathematics Techbook taps into students' preferences of consuming digital content and provides highly engaging, standards-based content guaranteed to inspire and encourage students to delve deeper into mathematics.

The Primary 4 Mathematics Techbook features rich multimedia resources: video, images, informational text, and more. Online mathematics tools allow all students to access and use tools that mathematicians use to analyze and solve problems, including calculators, geometry tools, construction tools, and whiteboards.

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Interdisciplinary Projects: Content and Real-World Connections

A unique addition to the Primary 4 Mathematics Techbook is the Interdisciplinary Projects, provided for students once per term. These Interdisciplinary Projects are based on real-world challenges derived from the United Nations Sustainable Development Goals. Countries across the globe adopted these Sustainable Development Goals in 2015 (with annual monitoring and tracking) to "end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.[1]"



For students to authentically connect to academic content, practice life skills, and deeply understand Egyptian Issues, we must provide opportunities for students to search for their own solutions. The Interdisciplinary Projects allow students to do just that. Students are presented with a challenge and then given the opportunity to generate ideas using knowledge and skills from science, mathematics, and other disciplines. Students work with classmates to design a solution to build, test, and refine using the Engineering Design Process.

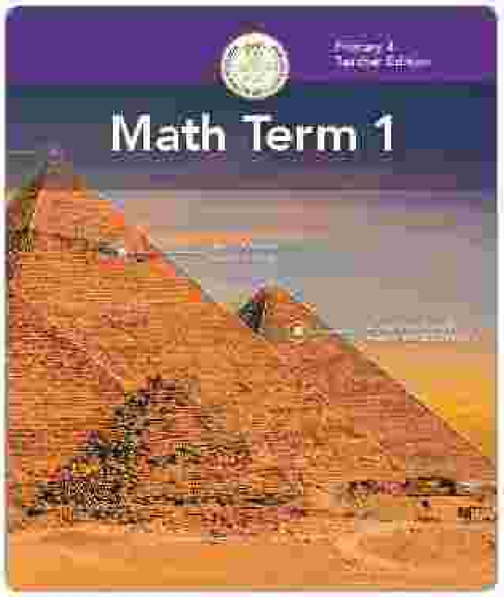
The first Interdisciplinary Project, "To Get to the Other Side," challenges students to think about sustainability in a community that includes humans and other living organisms. Students consider the needs of a reptile, the blue Sinai agama, and how these lizards interact with a school community's needs for a new sidewalk.



[1] https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

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Teacher Edition



The **Primary 4 Mathematics Teacher Edition** is designed to support instructors in the preparation and implementation of rich and engaging learning experiences. It provides clear step-by-step instructions embedded with teacher input, instructional strategies, and classroom management techniques. In these learning experiences, students explore, play, use manipulatives, communicate and collaborate with peers, ask and seek answers to questions, and practice new skills and concepts.

This instructional approach aims to help students accomplish the following goals:

- build numeracy
- discover connections between and among math concepts
- develop computational fluency
- acquire and use math vocabulary
- build awareness of measurement and geometry concepts
- enhance critical thinking, problem solving, collaboration, and communication
- increase enjoyment of math

If instructors have not used such a guide before, some practical advice follows:

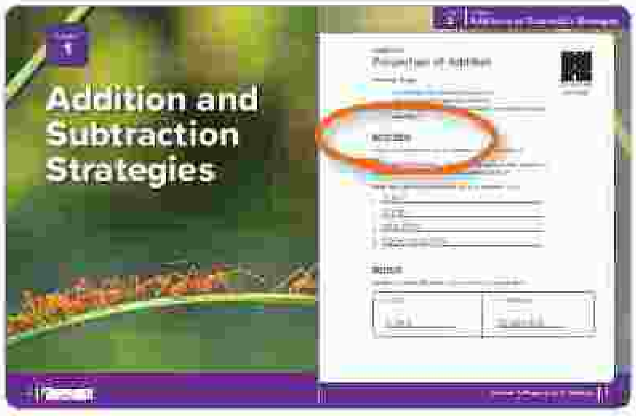
- read each unit carefully in advance of instruction. Make notes and highlight important details.
- ddvance preparation will ease the instructor's workload and ensure successful learning experiences for students.
- gather the necessary materials and make any preparations before implementing the lessons.
- consider additional classroom management techniques necessary for your particular class and learning environment.

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Student Edition

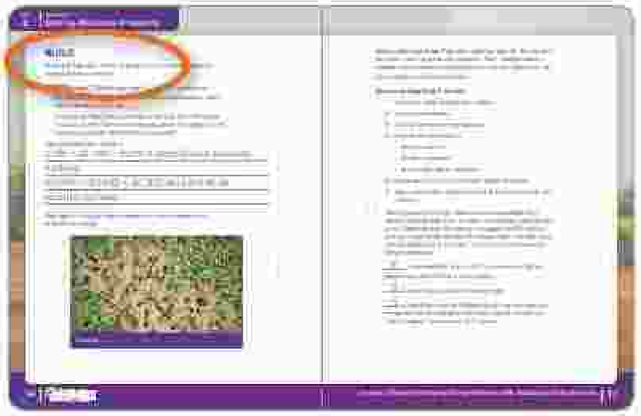
The Primary 4 Mathematics Student Edition contains Learning Targets; ACCESS, BUILD and CONNECT sections; and Practice, Index, Student Resource, and Glossary pages.

ACCESS



- ACCESS provides a space for students to record their work and thinking as they participate in the ACCESS activity.
- Students work independently, in pairs, in small groups, or with the whole class to develop computational fluency and build deep conceptual understanding.
- Students work with the teacher and one another to build connections between prior knowledge and new learning.
- Students engage in error analysis to review and reinforce previously-learned skills and concepts.
- In error analysis, students review example work (work that was not completed by students in the class) and identify what was done correctly and incorrectly. Students are then given the opportunity to solve the problem on their own. Error analysis is important because it promotes higher-level thinking and aids in conceptual understanding. It also helps students feel comfortable with checking their own work and analyzing their own errors.

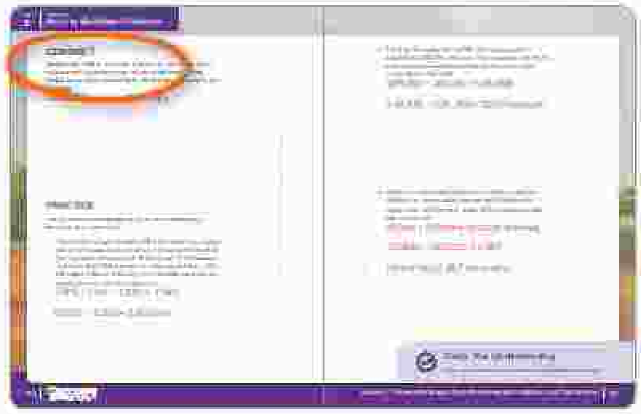
BUILD



- BUILD provides an opportunity for students to immediately apply the skills and concepts they are learning in class.
- Students work independently, in pairs, and in small groups to explore, discover, and apply new skills and concepts.
- Students have multiple opportunities to check their work and the work of others. This kind of error analysis strengthens students' learning and deepens their understanding of mathematical concepts and connections.
- BUILD is an excellent resource for informally assessing student progress.

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CONNECT



- Students reflect on their learning through drawing, writing, and completing related math activities.
- Writing About Math provides opportunities for students to make written connections between new content and previous learning and between formal math concepts and the real world.
- Writing About Math is another great resource for informally assessing student progress and gathering information about students' current understanding and potential misconceptions.

Resource Pages

These pages appear at the end of the Teacher Edition and include math tools and resources for students. Students may tear out these pages and cut, color, or use resources pages as directed by the teacher. Digital versions of these pages may be printed out and photocopied for student use.

The information you gather from the ACCESS, BUILD, AND CONNECT sections can be used to plan future instruction and differentiation (see Assessment).

Take note of the following:

- What are students discovering or learning? (Content)
- What are students' misconceptions or misunderstandings? (Remediation)
- What are students being asked to do? (Activity)
- What is the teacher discovering about students? (Assessment)
- How could you adapt the lesson for the different abilities in your class? (Differentiation)

During and after the implementation of each lesson, reflect and make notes on what was successful as well as possible suggestions for improvement.

Planning with another instructor can often lead to greater implementation success as it provides an opportunity to discuss classroom expectations, management procedures, and strategies for differentiation according to the needs of students. It is suggested that teachers meet with other instructors at least weekly to plan and reflect.

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Formative Assessment

What is formative assessment?

The term *assessment* often brings to mind exams. Exams can be effective at summarizing learning at the end of a chapter, unit, instructional period, or school year. After a student learns material for a certain amount of time, an exam measures how much the student has learned, retained, and can apply. **Formative assessment** encompasses strategies used in the classroom to find out if and how much students are learning along the way, so that instruction can be adjusted.

Why embed formative assessment in instruction?

Formative assessment is a tool that supports responsive teaching. Embedding formative assessment provides instructors with evidence about how much students are learning, retaining, and applying. A teacher who frequently seeks and receives feedback about how much progress students are making toward learning goals can adjust instruction to respond to misconceptions, misunderstandings, and gaps in students' ability to apply learning.

How does embedding formative assessment improve learning?

The following table (William, 2011) provides an overview of five strategies that instructors, peers, and students can use to give and receive evidence of learning throughout the learning process.

<table>
<tr><th></th><th>Where the Learning Is Going</th><th>Where the Learner Is Right Now</th><th>How to Get There</th></tr>
<tr><th>Teacher</th><td rowspan="3">Clarifying, sharing, and understanding what we intend for students to learn and the criteria for success</td><td>Eliciting evidence of learning</td><td>Providing feedback that moves learning forward</td></tr>
<tr><th>Peers</th><td colspan="2">Activating learners as instructional resources for one another</td></tr>
<tr><th>Learner</th><td colspan="2">Activating learners as owners of their own learning</td></tr>
</table>

Wiliam, Dylan. Embedded Formative Assessment. Bloomington: Solution Tree Press, 2011.

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The first essential step is to identify (and share with students) the desired learning targets, or "where the learning is going." Once learning goals are established, teachers, peers, and students themselves can check in on "where the learner is right now," or how much progress is being made toward the goals. Rather than assessing whether or not a student has sufficiently learned content after the fact, formative assessment practices provide feedback so that teaching and learning ("how to get there") can be adjusted to better obtain the agreed-upon goals.

What does embedding formative assessment look like in the classroom?

Formative assessment often occurs through classroom discussions and tasks that ask students to explain and justify their thinking. If individual students struggle to understand or apply a concept, a teacher can differentiate instruction or provide peer support to meet that students' needs. Instructors can also gather information about student learning during instruction. For example, by walking around the classroom and checking students' work as they practice new learning in BUILD, teachers can learn a great deal very quickly about students' understanding and misconceptions. When many students exhibit evidence of misunderstanding or gaps in knowledge or skills, a teacher can decide to review, reteach, or present a new approach to achieving the learning goals.

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Thinking Like a Mathematician

Students were introduced to the idea of thinking like a mathematician in Primary 3. As students begin to learn more complex and challenging mathematics, learning and practicing these skills and behaviors will help them become thoughtful, responsible learners. The instructor is advised to create a "Thinking Like a Mathematician" anchor chart (as shown below) to display throughout the year.

Good Mathematicians...	
Persevere	I can make sense of problems and keep trying.
Represent	I can show what the problem is asking in pictures, numbers, and words.
Explain	I can explain my thinking and work and compare my strategy with others.
Model	I can apply what I know about math in different problems.
Use Tools	I can choose appropriate tools and use them effectively to solve problems.
Are Accurate	I work carefully and check my work to make sure it is accurate and precise.
Use Structure	I can find patterns and use what I know to solve new problems.
Notice Patterns	I can use what I notice to explain rules and shortcuts when solving problems.

There are references to the "Thinking Like a Mathematician" skills and behaviors throughout the lessons. However, it is recommended that the instructor refer students to the anchor chart during instruction whenever possible and helpful, whether or not it is noted in the Teacher Edition.

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Instructional Strategies

Many of the instructional strategies described below are woven throughout the Primary 4 Mathematics Teacher Edition. These are not meant to be the only methods used in the classroom; rather they are highlighted as best practices for engaging students in active, inquiry-based learning. As teachers and students gain familiarity with the strategies, instructors may wish to modify and personalize to suit the needs of each individual classroom.

Instructional Strategy Name	Brief Description
Ask 3 Before Me	Students ask three peers for assistance before asking the teacher. This strategy is used when students are working collaboratively to develop communication skills, encourage peer interactions, and decrease reliance on the teacher's support in large classrooms.
Attention-Getting Signal	The teacher uses an explicit signal to get the attention of the class when they are talking in pairs or working in groups. There are many options for signals, and more than one can be used as long as students recognize it. Options include a clap pattern that students repeat, a simple call and response phrase, or a hand in the air (see: Hands Up). This strategy allows teachers to ask for students' attention without shouting or immediately disrupting student conversations.
Brainstorm	Students provide multiple answers for an open-ended question. This can be done as a whole class or in groups or pairs. The purpose of a brainstorm is to list many answers, not to critique whether answers are realistic, feasible, or correct. Once an initial broad list is made, students can go back to answers to prioritize or eliminate some options. This strategy promotes creativity and problem-solving.
Calling Sticks	Teacher writes the names of students on popsicle sticks and places them in a can/jar. To call randomly on students, the teacher pulls a stick from the jar. After calling on the student, the teacher places that stick into another can/jar so that student is not immediately called on again. This strategy helps teachers call on a wide variety of students and encourages all students to be ready with an answer.
Count Off	Teacher breaks students into groups by having students count off to a certain number. It is important to tell students to remember their number. For example, if the teacher wants three groups, the first student counts one, the next student says two, the next say three, and the next student starts over at one, and so on. When all students have counted, tell all the number ones to meet together, all the number twos, and then all the number threes. This strategy enables time-efficient grouping and reinforces conceptual number use.
Fishbowl	Students gather around a teacher or group of students who are modeling something new. The students observe carefully as if they are watching fish in a bowl. This strategy promotes the full attention of students even when individual students are not actively participating in the demonstration.

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Instructional Strategies and Differentiation

Instructional Strategy Name	Brief Description
Fist-to-Five	Student self-reflect using a "Fist-to-Five," where "fist" indicates no understanding and "five fingers" indicates a deep understanding of all terms.
Four Corners	Each of the four corners of the room corresponds to a possible opinion about a thought-provoking statement. The teacher may post a picture or a prompt in each corner of the room to represent the opinions/statements. Students walk to the corner that interests them or expresses their opinion to group with other like-minded students. This strategy allows students to express opinions and to prepare justifications with others who agree before presenting to the class.
Gallery Walk	As if in a museum, students walk past displays and respond to questions or prompts about the display. This strategy can be used in multiple ways, including to consider ideas posted on chart paper around the room or to view classmates' final products. This strategy encourages diversity of thought. When used at the end of a project, this strategy allows students to celebrate and take pride in their work while also honoring and responding to others' work.
Hands Up	The teacher holds a hand in the air to signal that students should stop what they are doing, stop talking, and look up at the teacher. When students notice the teacher's hand up, they also raise a hand to signal to classmates. This strategy is used as an attention-getting signal.
Hands Up, Pair Up	Students stand and walk around the room quietly with one hand raised in the air. The teacher says, "Stop—Pair Up." Students clap hands and stand together with a nearby student. Anyone with a hand still up needs as a partner. Students can easily find each other and pair up.
I Do, We Do, You Do	I Do: Teacher demonstrates or models an action to take place, such as reading a passage to the students. We Do: Students repeat the action with the teacher, such as re-reading a passage in unison. You Do: Student practices the learned action without the guidance of the teacher. This strategy supports students by modeling an expectation, allowing for low-pressure practice, then providing opportunities for independent practice.
Jigsaw	Students are divided into small "home" groups (for example, groups A, B, C, D, and E). The teacher provides different instruction (or instructional materials) to each "home" group so that each group becomes the "expert" in their unique skill or strategy. For example, there is a group of A experts, B experts, C experts, and so on. The teacher then carefully regroups students so that each new small group has at least one member of each "home" group. For example, each new group will now have one A, one B, one C, and so on. Student experts teach each other what they have learned. This strategy helps students develop ownership of their own learning, confirm their understanding, and build confidence in their mathematical abilities.

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Instructional Strategy Name	Brief Description
Lean and Whisper	Students lean one shoulder in toward one neighbor to answer a question that has a one- or two-word (or short) answer. This strategy engages all students in answering a question without disrupting the flow of the classroom.
Model	The teacher or student demonstrates exactly how to complete a task. The rest of the class can ask questions before repeating what was demonstrated. This strategy allows the teacher to review any safety concerns or difficult aspects of a task, as well as share advice for task completion. This method should not be used for some inquiry activities, as it could over-influence the direction of student thinking.
One Stay One Stray	After working with partners, one person stays with the work product to present to other students while the second partner walks around and listens to peers in the class share. Then the two students switch roles. Using the strategy, both partners get to share their project and listen to others share.
Popcorn	Call on one student to answer a question. After the student has answered the question, they say, "Popcorn," and say the name of another student. It is now the turn of that student to answer the question, then pick a new student, and so on. If a student has responded, they should not be called upon a second time during the same Popcorn activity.
Relay Race	Divide the class into teams and have them line up single file. Call one student from each team to the front of the class. Ask students a question and the first to answer receives a point for their team. After answering, the student goes to the end of the line and the next student goes to the front of the room. A variation for math problems is for students to complete only one part of a math problem at a time.
Shake It Share It High Five	Students move around the classroom until the teacher signals to stop. Students then partner with a nearby student. Partners shake hands, share ideas or work products, then high five before moving around again to find a new partner. This strategy gets students out of their seats and moving, while also allowing them to share with classmates they do not sit near.
Shoulder Partners	Students lean and talk quietly with the person sitting next to them. Shoulder Partner can be used literally to just talk to the people sitting on either side, or it can be used for slightly larger groups of three or four with everyone's shoulders "touching." (This promotes the ability to speak softly—in sort of a huddle).
Think Aloud	The teacher models a process of thinking by speaking aloud what is thought. As an example, "I think I need more color here in my drawing." This strategy models for students the type of thinking they can use in an upcoming activity.
Snowball Fight	Students respond to a prompt using a half sheet of paper. The student crumples the paper up like a snowball and tosses it across the room. Students pick up a snowball that lands close to them, add their comment or answer, and crumple to toss again. Repeat as needed. The strategy encourages students to interact with the ideas of students who do not sit nearby in an anonymous manner.

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Instructional Strategy Name	Brief Description
Think Time	Teacher allows a distinct period of silence so that students can process tasks, feelings, and responses. Allow students 15 to 30 seconds to think to themselves before calling on anyone to provide an answer to the class. This strategy is particularly helpful for shy or quiet students, as well as students who prefer to process content individually before contributing to a classroom or group conversation.
Thumbs Up	The teacher can quickly check for understanding using this strategy. Students hold thumbs up for agreement and thumbs down for disagreement to a question asked by the teacher. Thumbs up can also be used as a way for students to signal to a teacher that they are ready for an instruction. Thumbs Down should never be used to denote disagreement with a student's answer or idea.
Turn and Talk	Students turn "knee to knee" and "eye to eye" with a Shoulder Partner to discuss answers to long-form questions. This strategy allows students to discuss ideas, reflect on learning, and check each other's answers.
Venn Diagram	Teacher draws two or more large overlapping circles as a graphic organizer to show what is the same and different about multiple topics. Teacher notes similarities in the overlapping section of the circles, then summarizes differences in the respective parts of the circles that do not overlap. This strategy allows students to visually see and record similarities and differences.
Wait Time	Similar to the Think Time strategy, the teacher waits at least seven seconds after asking a question to the whole class or after calling on a student to respond. This provides time for students to think independently before an answer is given out loud.

Differentiated Instruction

Primary 4 Mathematics Techbook allows teachers to differentiate instruction, degrees of readiness, and interests. Techbook also offers resources to help vary content, process, product, and learning environment through the core instructional pathway.

Built upon the principles of Universal Design for Learning, Primary 4 Mathematics Techbook features a variety of content types, including images, video, text, and Hands-On Activities. These resources, included in both digital and print, provide multiple representations of the content and the flexibility for teachers to assign targeted content to whole groups or individual students.

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Primary 4 Mathematics Scope and Sequence

An ● Indicates initial introduction of content. Practice and application should continue beyond initial instruction.

Primary 4 • THEME	1	2	3	4
MATHEMATICS				
A. Numbers and Operations in Base Ten				
1. Apply and extend understanding of the place value system to multidigit whole numbers.				
a. Demonstrate understanding that in a multidigit whole number, a digit in one place represents ten times what it represents in the place to its right.	●			
b. Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.	●			
c. Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.	●	●		
d. Use place value understanding to round multidigit whole numbers up to the milliards (billions) place.	●	●		
e. Order a set of numbers up to a milliard (billion).	●			
f. Compare two multidigit numbers using the symbols <, >, = to express the relationship.	●			
2. Use place value understanding and properties of operations to perform multidigit arithmetic.				
a. Fluently add and subtract multidigit whole numbers.	●	●		
b. Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.	●	●		
c. Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.	●	●		
d. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.	●	●		
e. Illustrate and explain calculations using equations or models.	●	●		

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Scope and Sequence

Primary 4 • THEME	1	2	3	4
3. Use place value to read and write decimals to the Hundredths place.				
a. Read and write decimals to Hundredths using numerals, word form, and expanded form.			•	
b. Use models to illustrate and compare decimals to Hundredths.			•	
B. Numbers and Operations – Fractions and Decimals				
1. Extend understanding of fraction equivalence and ordering.				
a. Explain cases of fraction equivalency by using visual fraction models.			•	
b. Explain how the number and size of the parts of equivalent fractions differ even though the two fractions themselves are the same size.			•	
c. Identify and generate equivalent fractions.			•	
d. Compare two fractions using different strategies (for example, by comparing two fractions with different numerators and different denominators by creating common denominator or numerators or comparing to a benchmark fraction).			•	
e. Demonstrate understanding that fraction comparisons are valid only when the two fractions refer to the same whole.			•	
2. Build fractions from unit fractions.				
a. Demonstrate understanding of fraction $\frac{a}{b}$ with a > 1 as a sum of fractions $\frac{1}{b}$. 1) Explain addition and subtraction of fractions as joining and separating parts referring to the same whole. 2) Decompose a fraction into a sum of fractions with the same denominator in more than one way.			•	
b. Add up to three fractions with like denominators where one of the fractions is a unit fraction.			•	
c. Add and subtract fractions and whole numbers.			•	
d. Add and subtract mixed numbers with like denominators using equivalent fractions or properties of operations and the relationship between addition and subtraction.			•	
e. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.			•	

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	1	2	3	4
f. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. 1) Demonstrate understanding that fraction $\frac{a}{b}$ is a multiple of $\frac{1}{b}$ 2) Demonstrate understanding that a multiple of $\frac{a}{b}$ is a multiple of $\frac{1}{b}$, and use this understanding to multiply a fraction by a whole number. 3) Solve word problems involve multiplication of a fraction by a whole number using numerals, words, and models.			•	
3. Understand decimal notation for fractions, and compare decimal fractions.				
a. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100 (for example express $\frac{2}{10}$ as $\frac{20}{100}$ and add $\frac{2}{10} + \frac{5}{100} = \frac{25}{100}$)			•	
b. Use decimal notation for fractions with denominators 10 or 100 (for example, write $\frac{62}{100}$ as .62).			•	
c. Compare two decimals to the Hundredths place			•	
d. Demonstrate understanding that decimal comparisons are valid only when the two decimals refer to the same whole.			•	
e. Record the results of decimal comparisons using the symbols <, >, =			•	
C. Operations and Algebraic Thinking				
1. Use the four operations with whole numbers to solve problems.				
a. Interpret a multiplication equation as a comparison (for example, 42 = 7 × 6 as a statement that 42 is 7 times as many as 6).	•	•		
b. Represent verbal statements of multiplicative comparisons as multiplication equations.	•	•		
c. Multiply or divide to solve word problems involving multiplicative comparison, (for example, using drawings and equations with a symbol for the unknown number to represent the problem).	•	•		

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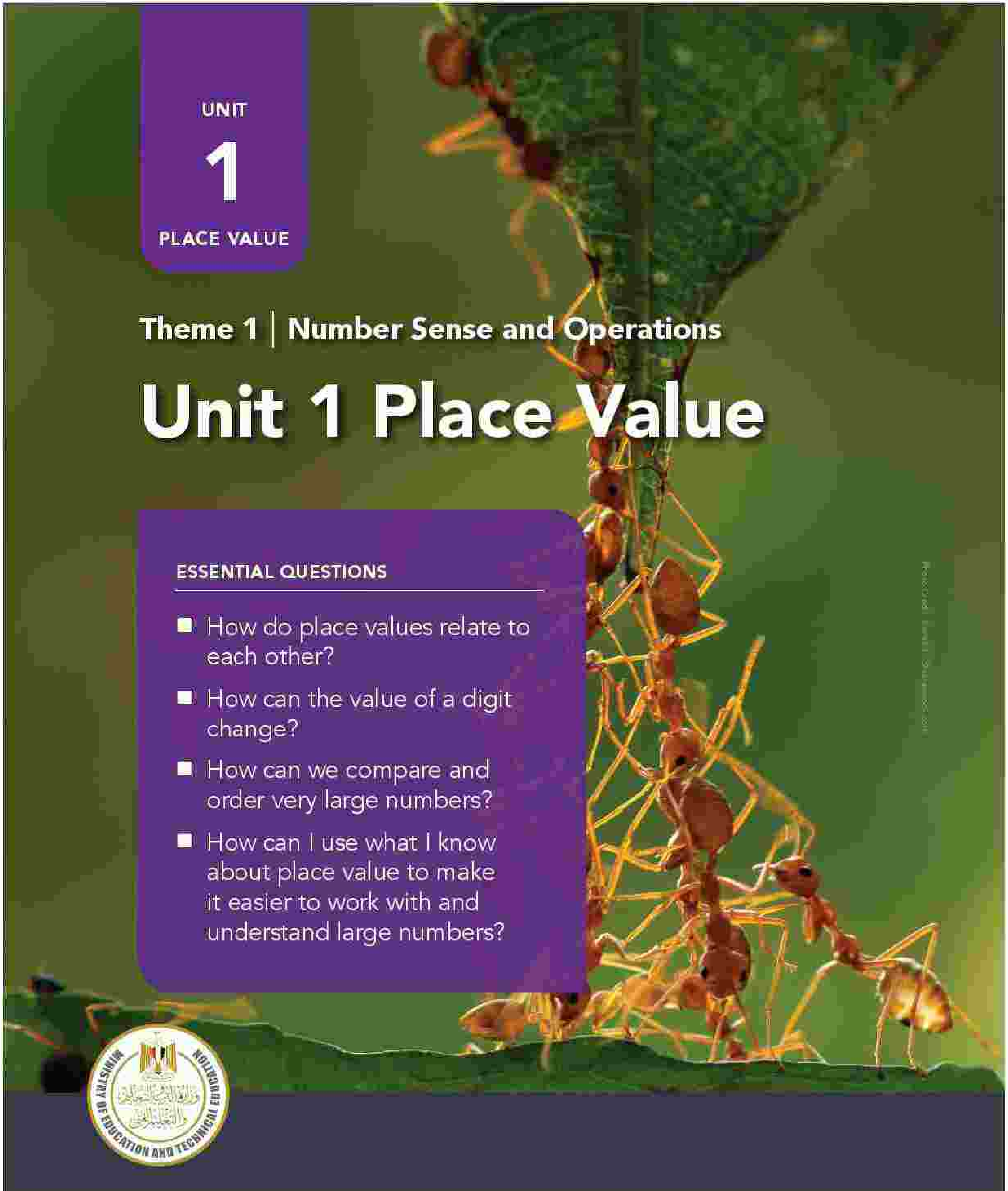
Scope and Sequence

Primary 4 • THEME	1	2	3	4
d. Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted. 1) Use letters in equations to represent unknown quantities.	•	•		
e. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	•	•		
f. Follow the standard order of operations to solve equations with multiple operations.	•	•		
2. Gain familiarity with factors and multiples.				
a. Demonstrate understanding that a whole number is a multiple of each of its factors. 1) Find all factor pairs for a whole number in the range 1–100.		•		
b. Find common multiples between two numbers.		•		
c. Find the greatest common factor between two whole numbers.		•		
D. Measurement and Data				
1. Solve problems involving measurement and conversion of measurements.				
a. Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).	•			
b. Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.	•			
c. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.	•			
d. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.	•		•	
2. Ask and answer questions by collecting, organizing, and representing appropriate data.				
a. Select and make an appropriate graph to display a data set of measurements in fractions of a unit (for example, line plot, bar graph, or double bar graph).			•	

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	1	2	3	4
b. Solve problems involving addition and subtraction of fractions by using information presented in graphs (for example, from a line plot find and interpret the difference in height between the tallest and shortest students in the classroom).			•	
E. Geometry				
1. Draw and identify lines and angles, and classify shapes by properties of their lines and angles.				
a. Identify points, lines, and angles in two-dimensional figures.				•
b. Demonstrate understanding that angles are geometric shapes that are formed wherever two rays share a common endpoint.				•
c. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines.				•
d. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size.				•
e. Demonstrate understanding of right triangles as a category, and identify right triangles.				•
f. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts.				•
g. Identify line-symmetric figures and draw lines of symmetry.				•
2. Geometric measurement: understand concepts of angle and measure angles.				
a. Demonstrate understanding that an angle is measured with reference to a circle with its center at the common endpoint of the rays by considering the fraction of the circular between the points where the two rays intersect the circle. 1) An angle that turns through $\frac{1}{360}$ of a circle is called a "one-degree angle". 2) An angle that turns through *n* one-degree angles is said to have an angle measure of **n** degrees.				•
b. Use non-standard tools to measure and draw angles (for example, paper models and analog clocks).				•
c. Use a protractor to measure angles of 30°, 45°, 60° and 90°.				•

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UNIT

1

PLACE VALUE

Theme 1 | Number Sense and Operations

Unit 1 Place Value

ESSENTIAL QUESTIONS

- How do place values relate to each other?
- How can the value of a digit change?
- How can we compare and order very large numbers?
- How can I use what I know about place value to make it easier to work with and understand large numbers?

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

Video Questions

The Unit 1 Opener Video, Mighty Ant Facts, uses ant facts to introduce students to very large numbers. In this unit, students are introduced to Omar and Mariam, two students who are amateur myrmecologists. A myrmecologist is someone who studies ants. As part of their ant study project, they find ant colonies, study ant behaviors, and count ants to track populations and the health and variety of local ant colonies. This research requires them to count, read, write, and compare very big numbers.

Quick Code
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- How can we use what we already know about place value to learn about numbers to the Milliards place?
- What strategies can we use to read and write really big numbers?
- How can we use place value to compare and order really big numbers?

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

accurate, amateur, ascending, compare, compose, decompose, decomposed form, descending, digit, efficient, equal to, error analysis, estimation, expanded form, front-end estimation, greater than, less than, milliard, myrmecologist, nearest, number, numeral, order, period, place values, reasonable, rounding, standard form, word form

Quick Code
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Unit Storyline

Unit 1 Place Value Storyline

The Place Value unit extends students' working knowledge of whole numbers and the place value system in the context of comparing and rounding numbers. Students apply these understandings to large numbers (to the billions, or milliards). To support learning, students observe video footage and investigate problems of ants within colonies to enhance their knowledge of whole numbers and place value within large numbers.

Unit Standards

4.A.1	Apply and extend understanding of the place value system to multi-digit whole numbers.
4.A.1.a	Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
4.A.1.b	Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.
4.A.1.c	Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.
4.A.1.d	Use place value understanding to round multi-digit whole numbers through the One Milliard (One Billion) place.
4.A.1.e	Order a set of numbers through the One Milliard (One Billion) place.
4.A.1.f	Compare two multi-digit numbers using the symbols <, >, = to express the relationship.
4.C.1	Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.
4.C.1.a	Interpret a multiplication equation as a comparison (for example, $42 = 7 \times 6$ as a statement that 42 is 7 times as many as 6).
4.C.1.e	Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Unit 1 Structure and Pacing

This structure and pacing guide is based on a Mathematics program that is 60 minutes/5 days a week. See the Alternate Pacing Guides for recommendations for 45-minute and 90-minute lessons.

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.

Concept 1: Reinforcing Place Value

Essential Questions

- How can I use mathematical vocabulary to build understanding of place value?
- How does the value of a digit change as it moves in a whole number?
- How does the value of a digit change as it moves one place to the left within a whole number?
- How can numbers be broken apart?
- How does breaking numbers apart help us understand them?

Lesson 1	**Review Digit, Numeral, Number** **Learning Objectives** • Students will explain the difference between a digit, numeral, and number. • Students will discuss how the value of a digit can change. **Student Learning Targets** • I can explain the difference between a digit, numeral, and number. • I can discuss how the value of a digit can change.
Lesson 2	**Really Big Numbers!** **Learning Objectives** • Students will identify all whole number place values through the One Milliard place. • Students will explain how the value of a digit changes based on its place in a number. **Student Learning Targets** • I can identify all whole number place values through the One Milliard place. • I can explain how a digit's location in a number affects its value.

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Unit Structure and Pacing *cont'd*

Lesson 3	**Changing Values** **Learning Objectives** • Students will explain how the value of a digit changes as it moves to the left in a whole number. • Students will describe patterns they observe in changing place values. **Student Learning Targets** • I can explain how the value of a digit changes as it moves to the left in a number. • I can describe the patterns I see as a digit changes value.
Lesson 4	**Review Comparing Values** **Learning Objectives** • Students will explain the relationship between a given place value and the place value to its left. • Students will use multiplication to compare place values. **Student Learning Targets** • I can explain the relationship between place values. • I can use multiplication to compare place values.
Lesson 5	**Many Ways to Write** **Learning Objective** • Students will write numerals in standard, word, and expanded forms. **Student Learning Target** • I can write numerals in standard, word, and expanded forms.
Lesson 6	**Composing and Decomposing** **Learning Objective** • Students will compose and decompose numerals in multiple forms. **Student Learning Target** • I can build and break down numerals in multiple forms.

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	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to place value. **Student Learning Target** • I can correct my misconceptions and errors related to place value.

Concept 2: Using Place Value

Essential Questions

- How can we efficiently compare and order very large numbers?
- How can understanding place value help us order very large numbers?
- How does estimating help me solve problems?
- How can place value help us understand rounding?

Lesson 7	**Review Comparing Really Big Numbers** **Learning Objectives** • Students will use place value to compare large numerals. • Students will use symbols to express numerical comparisons. **Student Learning Target** • I can use symbols and place value to compare large numerals.
Lesson 8	**Comparing Numbers in Multiple Forms** **Learning Objectives** • Students will compare numbers in multiple forms. • Students will describe strategies for comparing numbers in multiple forms. **Student Learning Targets** • I can compare numbers in multiple forms. • I can describe the strategies I use to compare numbers.

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Unit Structure and Pacing *cont'd*

Lesson 9	**Descending and Ascending Numbers** **Learning Objectives** • Students will order numbers in multiple forms. • Students will describe strategies for ordering numbers in multiple forms. **Student Learning Targets** • I can order numbers in multiple forms. • I can describe the strategies I use to order numbers.
Lesson 10	**Predicting the Unpredictable** **Learning Objectives** • Students will explain front-end estimation. • Students will use front-end estimation to approximate large numbers. **Student Learning Targets** • I can explain front-end estimation with numbers in multiple forms. • I can use front-end estimation with numbers in multiple forms.
Lesson 11	**Rounding Rules** **Learning Objectives** • Students will apply multiple strategies to round numbers. • Students will discuss whether rounding or front-end estimation provide a more accurate estimate. **Student Learning Targets** • I can use multiple strategies to round numbers. • I can identify which estimation strategy provides more accurate estimates.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to comparing, ordering, and rounding numbers. **Student Learning Target** • I can correct my misconceptions and errors related to comparing, ordering, and rounding numbers.

Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

Reduce ACCESS by 3 minutes

Reduce BUILD by 8 minutes

Reduce CONNECT by 2 minutes

Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section:

- Discuss fewer examples
- Eliminate Shoulder Partner conversations
- Shorten class discussions
- Work with students to complete ACCESS problems

If Mathematics instruction is based on a combination of 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

Follow the 45-minute approach for the 45-minute days

Teach two 45-minute lessons on the 90-minute day

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

Increase ACCESS by 5 minutes

Increase BUILD by 20 minutes

Increase CONNECT by 3 minutes

Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section:

- Discuss additional examples as needed
- Extend class discussions
- Allow time for hands-on work with manipulatives and models
- Provide additional practice problems for students who need additional practice
- Encourage students to share and model their problem-solving strategies

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Mathematical Background Knowledge

Place Value

In Primary 4, students expand their understanding of numbers as they explore very large and very small numbers throughout the year. To ensure a foundation for reading, creating, comparing, and performing operations with these numbers, students begin by learning to differentiate between the terms *digit*, *numeral*, and *number*. This enables them to use accurate mathematical language and communicate clearly about large and small numbers. A *digit* is the single symbol used to make numerals. We use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 every day. A *numeral* represents the idea of a number. *Number* is the quantity we associate with a numeral. The distinctions in terminology in math relate to distinctions in language. The *letters* c-a-t make the *word* cat, which correlate with our understanding of the animal represented by the word "cat." The *digits* 2-6-1 make the *numeral* 261, which correlates with our understanding of the quantity represented by the *number* "261."

One way to help students understand these concepts is to explain that different languages use different digits and number systems to create numerals. For example:

Hindu-Arabic	0	1	2	3	4	5	6	7	8	9
Eastern Arabic	٠	١	٢	٣	٤	٥	٦	٧	٨	٩
Ancient Roman		I	II	III	IV	V	VI	VII	VIII	IX
Chinese	〇	一	二	三	四	五	六	七	八	九
Ancient Greek		α′	β′	γ′	δ′	ε′	ς′	ζ′	η′	θ′

In Primary 3, students learned place values up to the Hundred Thousands place. In Primary 4, students extend this understanding to periods in place value and the One Milliard place. The goal is for students to connect their new learning about place value to prior learning and to extend their understanding to read, write, and compare larger numbers.

Relationships in Place Value

Students also explore the relationship between each place value as digits move to the left within a number. They multiply by powers of 10 and observe patterns in the changing place values. It is important that students develop conceptual understanding of relational size and exponential growth as digits increase in place value.

In Primary 3, students learn to write numbers in standard, expanded, and word form to the Hundred Thousands place. In Primary 4, students extend this understanding to the One Milliard place. They practice creating and writing numbers to One Milliard in standard form, word form, and expanded form. Expanded form allows students a different opportunity to see that the digits used in a number represent a value based on their place value. Students also practice writing numbers in written form which reinforces how to read large numbers.

Composing and decomposing numbers is a key conceptual understanding that began early in students' educational career. For example, in Primary 2, students learned different ways to compose the number 10 (combinations of 6 + 4, 3 + 7, and so on). In Primary 3, students began composing numbers with multiplication. In Primary 4, students compose numbers using many strategies including place value, factors, and addition.

Comparing and Ordering Large Numbers Using Place Value

In Primary 4, students apply their understanding of place value to compare and order very large numbers. However, instead of comparing and ordering numbers only in standard form, they compare and order them in standard, word, expanded, and decomposed forms. This helps students develop a deeper understanding of place value relationships. Additionally, students incorporate the terms ascending and descending into their mathematical vocabulary.

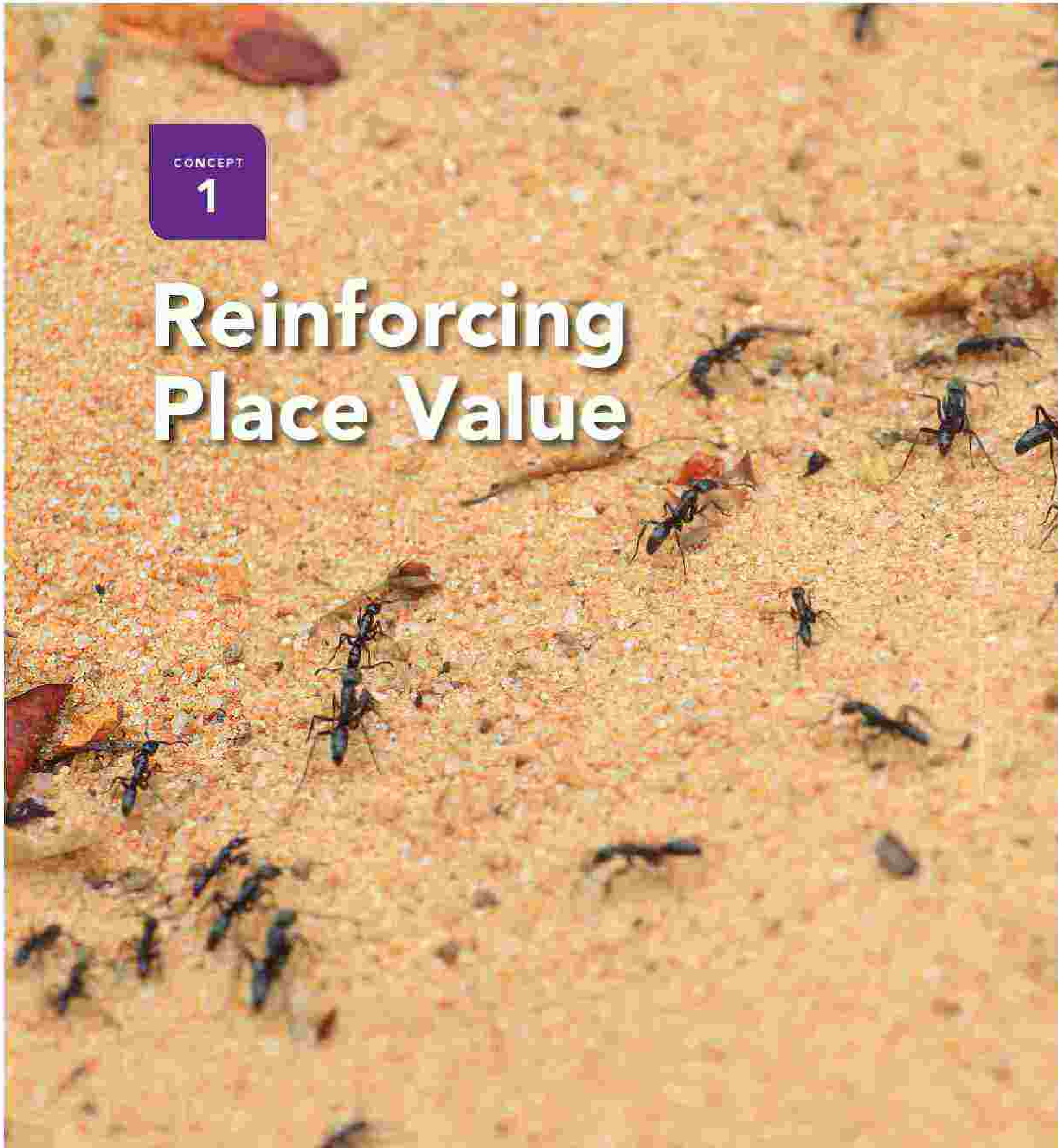
Estimating Using Place Value

In Primary 4, students review front-end estimation and apply that strategy to very large numbers in multiple forms. They review rounding and use different strategies to round numbers through the One Milliard place. They compare estimation strategies to identify which strategy provides the most accurate estimate. This helps them understanding the value of estimation—determining whether their answers are reasonable.

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CONCEPT 1

Reinforcing Place Value



Concept Overview

In Concept 1: Reinforcing Place Value, students investigate relationships between places in a place value chart, specifically how much a digit changes in value as it moves to the left within a whole number. Students review composing and decomposing numbers and apply their understanding to reading and writing numbers to the One Milliard place. These place value concepts help students master more challenging concepts in Primary 4, including multiplication, division, fractions, and decimals.

Concept Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

4.C.1 Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.C.1.a Interpret a multiplication equation as a comparison (for example, $42 = 7 \times 6$ as a statement that 42 is 7 times as many as 6).

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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Review Digit, Numeral, Number	• Notecards or paper (1 per student) • Lesson 1 Sorting Cards (Photocopy the Blackline Master).	Digit Numeral Number	• Students will explain the difference between a digit, numeral, and number. • Students will discuss how the value of a digit can change.	
2 Really Big Numbers!	• Place Value Chart (Project or recreate on blackboard) • Digit Cards 0–9 (1 set per student. Photocopy the Blackline Master and have the students keep these for future lessons.) • Scissors (1 per student)	Digit Milliard Period Place value	• Students will identify all whole number place values through the One Milliard place. • Students will explain how the value of a digit changes based on its place in a number.	
3 Changing Values	• Place Value Chart through the One Milliard place (Display on board) • Tens Rods (2 rods per student. Use Base Ten Blocks or photocopy the Blackline Master and cut apart the rods.) • Large Digit Cards 1–9 (1 set for the teacher. Photocopy the Blackline Master and save for future lessons.)	Amateur Milliard Myrmecologist Period Place value	• Students will explain how the value of a digit changes as it moves to the left in a whole number. • Students will describe patterns they observe in changing place values.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students often use the terms *digit*, *numeral*, and *number* and interchangeably, even though they have distinct differences. • Students often use the term *number* when referring to numerals. Since this is a common error, we understand each other. However, the term *digit* is distinct. • Students often look at digits without considering their place value. Where the digit falls in a numeral is critical to understanding its value.	Writing About Math, Vocabulary Builder, Practice, Check Your Understanding
	• Students may not understand that the position of a digit in a numeral determines its value. • Students may not recognize that there are relationships between place values. For example, in the number 333, the value of the 3 in the Tens place is 10 times greater than the value of the 3 in the Ones place. The value of the 3 in the Hundreds place is 10 times greater than the value of the 3 in the Tens place. • Students may struggle to read large numbers correctly utilizing Ones, Thousands, Millions, and Milliards.	Reading the Place Value Chart, Creating Really Big Numbers, Writing About Math, Practice, Check Your Understanding
	• Students may not understand that the position of a digit in a numeral determines its value. • Students may not recognize that there are relationships between place values. For example, in the number 333, the value of the 3 in the Tens place is 10 times greater than the value of the 3 in the Ones place. The value of the 3 in the Hundreds place is 10 times greater than the value of the 3 in the Tens place. • Students may struggle to read large numbers correctly utilizing Ones, Thousands, Millions, and Milliards.	What Is My Value?, Exploring Place Value Relationships, Multiplying Ants, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
4 Review Comparing Values	• Place Value Chart through the One Milliard place (Display on board) • Base Ten Blocks or place value manipulatives, plus one large set for the teacher o Base Ten Manipulatives are available at the end of the volume. o Allow time for students to cut out the manipulatives or have them do it for homework prior to this lesson. o Store manipulatives for future use. • Digit Cards 1–9 (1 set per student, kept from Lesson 2) • Large Digit Cards 1–9 (1 set for the teacher. Photocopy the Blackline Master.)		• Students will explain the relationship between a given place value and the place value to its left. • Students will use multiplication to compare place values.	
5 Many Ways to Write	• Digit Cards 0–9 (1 set per student, kept from Lesson 2)	Expanded form Standard form Word form	• Students will write numerals in standard, word, and expanded forms.	
6 Composing and Decomposing	• Place Value Chart through the One Milliard place (Display on board) • We Have/Who Has? Cards (1 set) and Answer Key (For the teacher) (Photocopy the Blackline Master)	Compose Decompose Decomposed form Expanded form Standard form Word form	• Students will compose and decompose numerals in multiple forms.	

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Common Misconceptions and Errors	Opportunities for Formative Assessment
• Students may be able to identify the place values and periods, but may not recognize the pattern or relationship between each place.	Writing About Math, Vocabulary Builder, Practice, Check Your Understanding
• Students may be confused about how to represent a place value with a 0 digit in expanded form. For example: 30,456 = 30,000 + 400 + 50 + 6. The 0 is not represented in expanded form because in standard form the 0 represents that there is nothing in that place value. • Students may struggle to say large numbers and need to be reminded to group the numbers into periods as they read them aloud. • Students may forget to use commas when writing numbers in word form.	Concept Check-In
• Students may not be sure how to represent a zero in a place when the number is decomposed. • Students may incorrectly use parentheses to group place values. • Students may not connect digits in their place values, expanded notation, and decomposing numbers. • Students may confuse the terms compose and decompose.	Writing About Math, Vocabulary Builder, Practice, Check Your Understanding

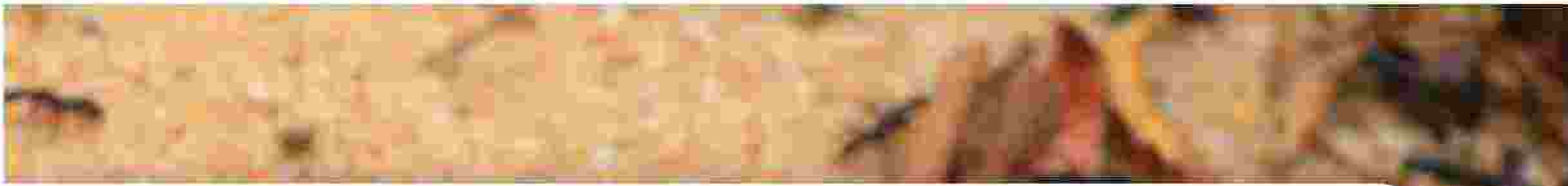
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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	Materials will vary	• Review vocabulary terms as needed.	• Students will work to correct misconceptions and errors related to place value.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not understand that the position of a digit in a numeral determines its value. • Students may struggle to read large numbers correctly utilizing Ones, Thousands, Millions, and Milliards. • Students may be able to identify the place values and periods but may not recognize the pattern or relationship between each place. • Students may be confused about how to represent a place value with a 0 digit in expanded form. • Students may struggle to say large numbers and need to be reminded to group the numbers into periods as they read them aloud. • Students may not be sure how to represent a zero in a place when the number is decomposed. • Students may not connect digits in their place values, expanded notation, and decomposing numbers.	Concept Check-In

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LESSON 1
Review Digit, Numeral, Number

Lesson Overview

In the first lesson of Primary 4, students explore large numbers in relation to ants. These large numbers launch the unit as students develop a common and strong understanding of mathematical language for discussing numbers. They then apply their understanding to large numbers and their values.

Lesson Essential Question

- How can I use mathematical vocabulary to build understanding of place value?

Learning Objectives

In this lesson

- Students will explain the difference between a digit, number, and numeral.
- Students will discuss how the value of a digit can change.

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

Vocabulary Check-In

digit, number, numeral

Materials List

- Notecards or paper
- Lesson 1 Sorting Cards

Preparation

Photocopy the Blackline Master at the end of this volume.

DIGITAL



Lesson 1
Review Digit, Numeral, Number

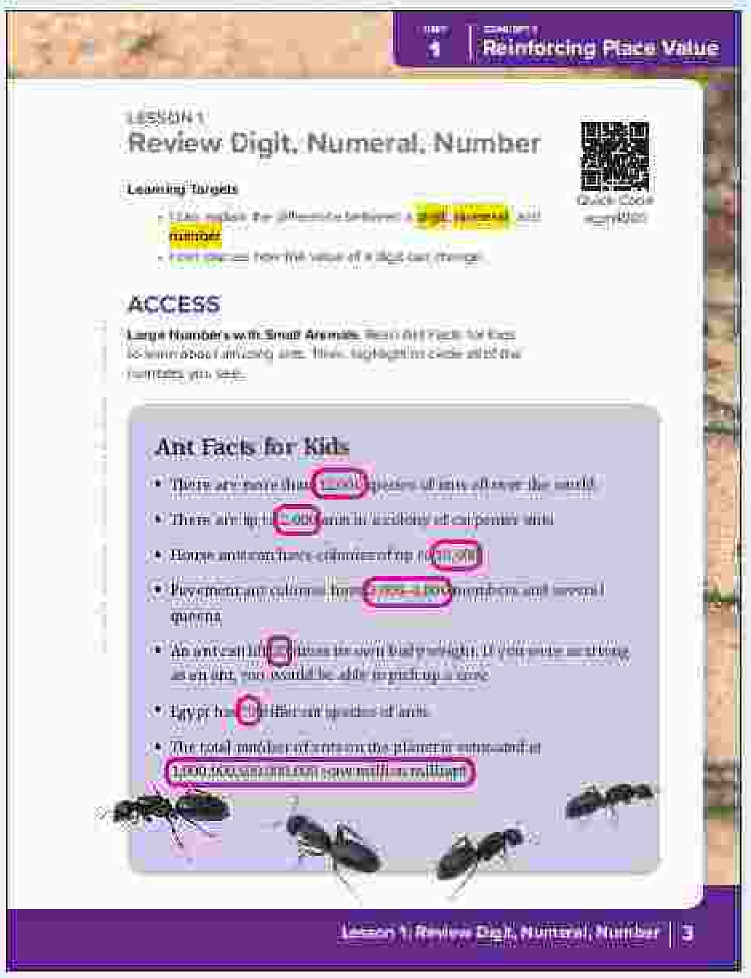
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Unit 1 | Reinforcing Place Value

LESSON 1

Review Digit, Numeral, Number

Learning Targets

ACCESS

Ant Facts for Kids

- There are more than 12,000 species of ants all over the world.
- There are up to 2,000 ants in a colony of carpenter ants.
- Pavement ant colonies have 3,000–4,000 members and several queens.
- The total number of ants on the planet is estimated at 1,000,000,000,000,000 (one million billion).

Lesson 1: Review Digit, Numeral, Number | 3

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students often use the terms *digit*, *numeral*, and *number* interchangeably, even though they have distinct differences.
- Students often use the term *number* when referring to numerals. Since this is a common error, we understand each other, but the term *digit* is distinct.
- Students often look at digits without considering their place value. Where the digit falls in a numeral is critical to understanding its value.

Large Numbers with Small Animals

1. Direct students to Lesson 1 ACCESS Large Numbers with Small Animals. Ask volunteers to read aloud the reading passage Ant Facts for Kids.
2. Ask students to highlight or circle the numbers in the list of facts.
3. Explain to students that they are beginning Primary 4 Mathematics with a focus on large numbers: reading them, writing them, and comparing them.
4. Ask for volunteers to explain why ants might be a good topic to explore while learning about large numbers. Explain that ants are discussed again in future lessons. Encourage students to make connections between what they are learning in Science and Math.

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BUILD (40 min)

Numeral Building (20 min)

TEACHER NOTE: This activity can serve as a formative assessment. For example, which students immediately write a numeral? Which students ask what a numeral is? For students who are unclear about the terminology, tell them to write a large number.

1. Direct students to Lesson 1 BUILD Numeral Building.
2. Instruct students to write any large numeral in the box (or on a piece of paper).
3. Ask students to compare their numeral with their Shoulder Partner to determine whose numeral is bigger and discuss how they know.
4. Repeat as many times as desired, asking students to find another partner by walking around the room or by swapping numerals with someone seated nearby.
5. Ask students to share how they figured out which numeral was bigger. Who wrote the biggest numeral in the class? What else did they notice?

Vocabulary Building (20 min)

1. Write the following on the blackboard or project on a whiteboard:

   Digit: ______________________________

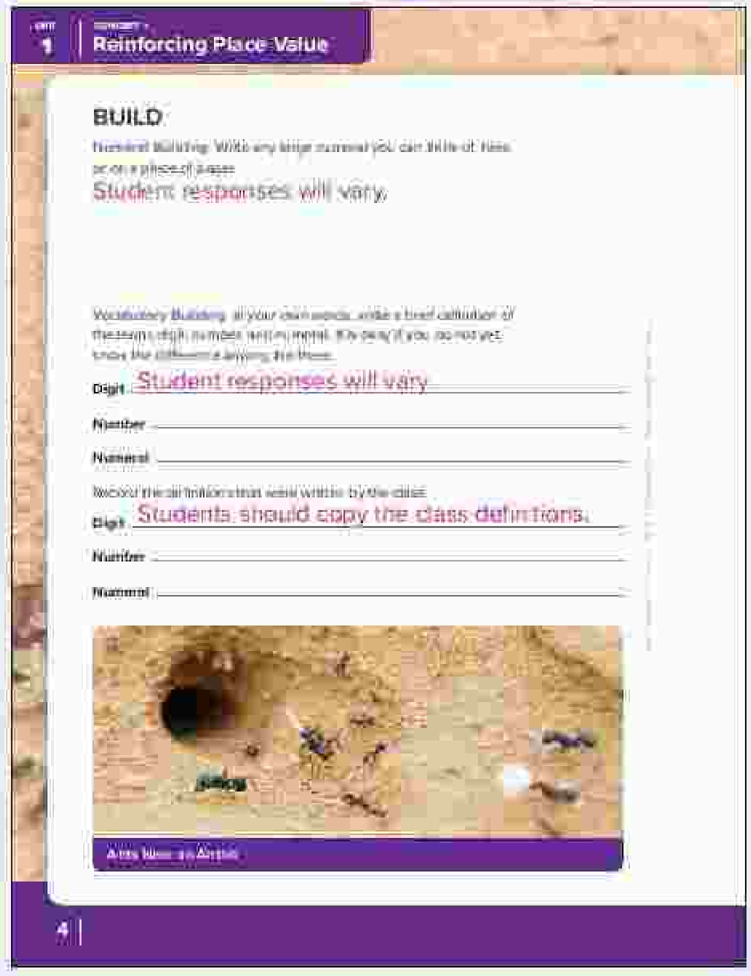
   Numeral: ______________________________

   Number: ______________________________

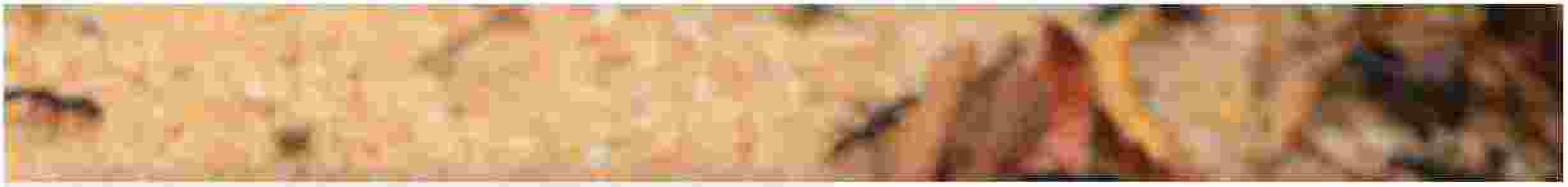
2. Direct students to Lesson 1 BUILD Vocabulary Building. Ask students to do a Quick Write to define each vocabulary term in their own words. Remind students that it is okay to take a best guess and write what they know.
   Answers will vary. It is okay if students do not know the definitions at this time.

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CONNECT

Writing About Math. Consider the numbers 26, 260, and 62. Explain what strategies you would use to determine the greatest number. Try to use the words digit, numeral, and number to explain your thinking. Be prepared to share your thinking with the class.

Students should mention the use of place value to compare the value of the digits in the different numerals or numbers.

PRACTICE

1. Write each number in the appropriate column. Some may go in more than one column.

983	thirty-seven	six	0
9	seventy-five	2,300,540	one hundred

Digit	Number	Numeral
0	983	983
9	0	Thirty-seven
	9	Six
	2,300,540	0
		One hundred
		9
		Seventy-five
		2,300,540

Lesson 1: Review Digit, Numeral, Number | 5

TEACHER NOTE: This activity can serve as a formative assessment. For example, what do students already know about these terms? What is confusing to them? Which students may be able to help other students build understanding?

3. Ask students to read the Learning Targets for the lesson and reflect on how well they can meet the targets right now. Consider asking students to self-reflect using a Fist-to-Five, where "fist" indicates no understanding and "five fingers" indicates a deep understanding of all terms. Discuss, if needed.

4. Display one sorting card at a time. For each card, give students a moment to discuss with their Shoulder Partner in which column the card belongs: digit, numeral, or number? Then ask students to share their answers with the whole group. Discuss/question students' thinking if all students do not agree.

ASK

- *Why do you believe this card belongs there?*
- *Could it also belong somewhere else?*
- *Why does it not belong in the other column/s?*
- *Does this card fit into more than one column?*

5. Complete the task with as many sorting cards as desired. Ensure all sorting cards are properly placed. Answer Key: two hundred, 35,646,788, three thousand four hundred twelve; 5, forty-nine, 45,646; 70,000,000; 1, eight, one million

6. As a group, define each term together based on what was learned during the experience. Record the definitions in the table on the board. (Refer to the glossary as needed.)

7. Ask students to write the class definitions of the terms *digit*, *numeral*, and *number*.
   The class definitions should be similar to the glossary definitions.

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UNIT 1 | CONCEPT 1

Reinforcing Place Value

CONNECT (6 min)

Direct students to Lesson 1 CONNECT Writing About Math and ask them to respond to the prompt.

WRAP-UP (4 min)

Let's Chat About Our Learning

After a few minutes of independent writing, ask volunteers to share their ideas. Reinforce place value concepts and correct use of the terms. Remind students that using accurate mathematical language can help them communicate their thinking more clearly. Students should mention the use of place value to compare the value of the digits in the different numerals or numbers.

PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions around digits, numbers, and numerals.

Check Your Understanding

1. Circle all the numerals below:

seven	Xxxxxx	345	forty-nine	16 dogs	0
704	ten birds	1,343,342	addition	twenty-six	2

2. Compare the numbers below and circle the greatest:

23,410	22,999
111,223	101,345
4,890	4,891

3. Use the following digits to make the largest number possible: 2, 8, 0, 4, 6. 86,420

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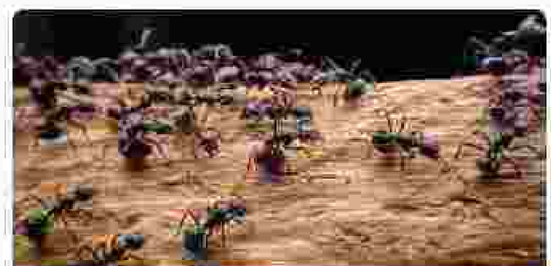
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UNIT 1 | CONCEPT 1 Reinforcing Place Value

2. Agree. Students may note that the three digits are 4, 5, and 8.

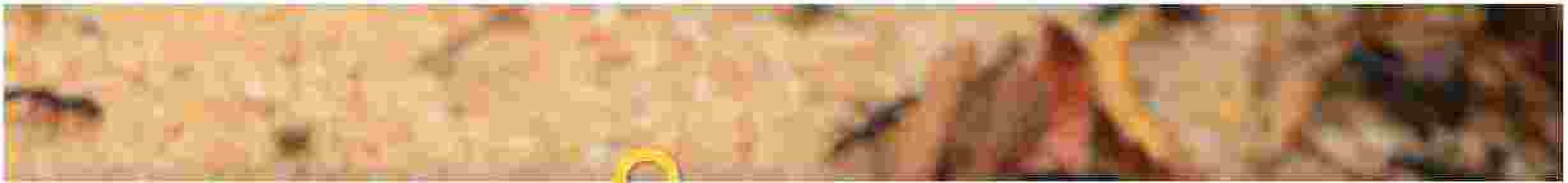
3. Accept as correct all numerals with five different digits.

Check Your Understanding



Carpenter Ants Building Nests in Wood

6



LESSON 2
Really Big Numbers!

Lesson Overview
In this lesson, students review place value concepts they learned in Primary 2 and Primary 3 and apply that learning to building understanding of place value through the One Milliard place. They play a game to practice creating, reading, and writing large numbers.

Lesson Essential Question
- How does the value of a digit change as it moves in a whole number?

Learning Objectives
In this lesson
- Students will identify all whole number place values through the One Milliard place.
- Students will explain how the value of a digit changes based on its place in a number.

Grade-Level Standards
4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

Vocabulary Check-In
digit, milliard, period, place value

Materials List
- Place value chart (Project or recreate on blackboard)
- Digit cards 0–9 (1 set per student)
- Scissors (1 per student)

Preparation
Keep the digit cards for future lessons.

DIGITAL

Lesson 2
Really Big Numbers!

Quick Code:
egmt4002

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that the position of a digit in a numeral determines its value.
- Students may not recognize that there are relationships between place values. For example, in the number 333, the value of the 3 in the Tens place is 10 times greater than the value of the 3 in the Ones place. The value of the 3 in the Hundreds place is 10 times greater than the value of the 3 in the Tens place.
- Students may struggle to read large numbers correctly utilizing Ones, Thousands, Millions, and Milliards.

Exploring Place Value

1. Direct students to Lesson 2 ACCESS Exploring Place Value. Ask students to talk to their Shoulder Partner about what they remember from earlier grades about the place value system and record their notes.
2. Ask a few volunteers to share their ideas. Students may remember different concepts, so answers will vary.
3. Project or draw the Place Value chart that follows. Cover the Millions and Milliard periods. Explain that the chart shows the Ones period and the Thousands period. Each period contains Ones, Tens, and Hundreds places. The names of the periods help us name numbers.

Milliards	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

4. Ask students to talk to their Shoulder Partner about things that can be represented by numbers in the Ones or Thousands periods. (For example, hundreds of students attend the school. Thousands of people live in the community.)
5. Reveal the next two periods (Millions and Milliards) on the place value chart.

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Student Pages 7–8



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6. Ask students to brainstorm things that can be represented by numbers in the Millions or Milliards periods. (For example, millions of people live in Cairo. Milliards of people live in the world.)

7. Display and ask students to read the statement, "For every 1 human on Earth there are about 1,000,000 ants." Allow students to react to the statement. Explain that they will return to that statement at the end of the mathematics period.

BUILD (40 min)

Reading the Place Value Chart (20 min)

1. Direct students to Lesson 2 BUILD Reading the Place Value Chart. Have students read aloud with you the labels for the place value chart. Begin at the Ones period and move through the One Milliard place (Ones, Tens, Hundreds, One Thousands, Ten Thousands, Hundred Thousands, One Millions, Ten Millions, Hundred Millions, One Milliard).

2. Guide students through practice reading five large numbers and writing them in a place value chart. Write large numbers on the place value chart and help students read them aloud with you. Ask students to record the numbers in their Student Materials. (For example, write 35,891,455 and chorally read "thirty-five million, eight hundred ninety-one thousand, four hundred fifty-five.") Remind students to say numbers grouped in each period followed by the name of the period (an example is shown below). Continue this practice of reading large numbers until most students respond with accuracy.

Milliards	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O
		3	5	8	9	1	4	5	5
	35 million			891 thousand			455		

3. Ask students to read the first learning target and reflect on how well they can meet the target right now. Use a "Fist to Five," where "fist" indicates no understanding and "five fingers" indicates a deep understanding of all terms.

Creating Really Big Numbers (20 min)

1. Ask students to Turn and Talk to discuss the following question: *Is a 2 always worth 2?*

2. Ask volunteers to share their thinking and model examples on the place value chart.

3. Direct students to Lesson 2 BUILD Creating Really Big Numbers. Give students time to cut apart the Digit Cards 0–9. Have them write their names or initials on the backs of their cards.

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TEACHER NOTE: Students will use these cards frequently throughout this unit. It is recommended that students keep their sets of cards for future game play or learning activities. They can store them in paper bags or plastic baggies until they need them.

4. Ask volunteers to read aloud the directions for the game Creating Really Big Numbers. Decide whether students will play in partners, small groups, or larger groups and divide them accordingly.

5. Give students 10–15 minutes to play. Then, stop and ask one student to write their greatest numeral on the board. Ask students to walk through each digit.

ASK
- *What is this digit?*
- *What is this digit's value?*
- *What would happen to the value of this digit if it were here (point to another place in the numeral)?*
- *Why did the value of the digit change when its location changed?*

6. Ask students to share how they determined who had the greatest numeral.

ASK
- *What strategies did you use to create the greatest numeral?*
- *If you could play this game again, what would you do differently?*

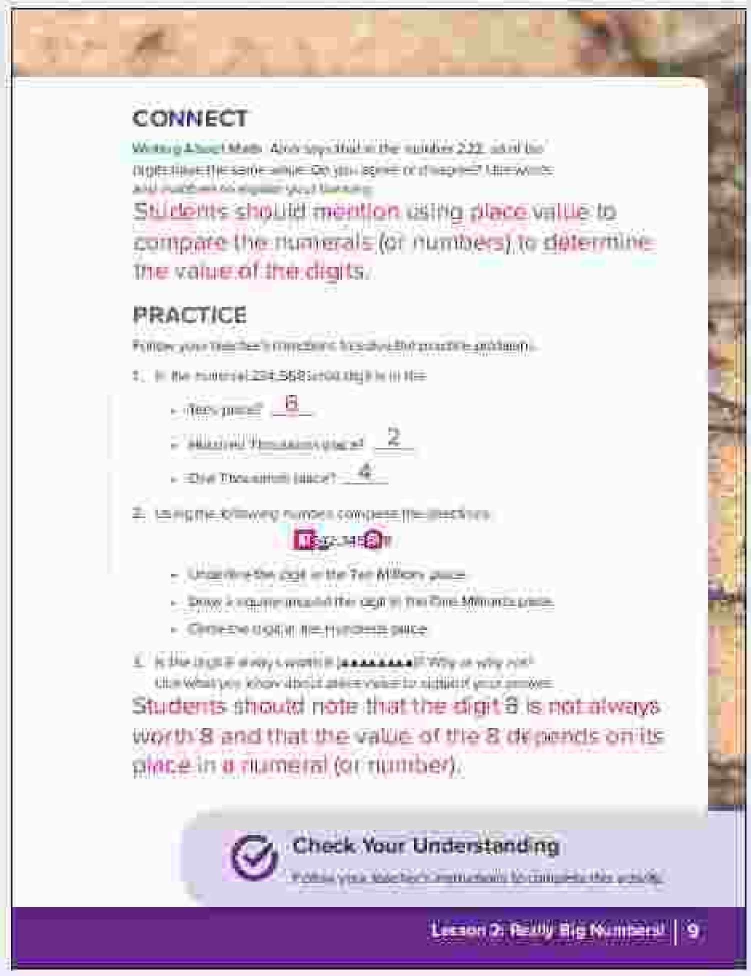
CONNECT (7 min)

Writing About Math

1. Direct students to Lesson 2 CONNECT Writing About Math and respond to the prompt.

2. After a few minutes of independent writing, ask students to share their answers and explain their thinking.
Students should mention using place value to compare the numerals (or numbers) to determine the value of the digits.

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WRAP-UP (3 min)

One Million Ants!

1. Ask students to reflect on the statement shared during ACCESS and then consider the question: *If there are 1,000,000 ants for every 1 person, how many people do you think it would take to have one milliard ants?*
2. Direct students to Turn and Talk to share their thinking with a friend.
3. Allow a few students to share and explain their thinking.
   It would take 1,000 people to have 1,000,000,000 ants. It is not required that students get the correct answer to this problem. It is more important that students engage in conversation about how to solve the problem. Listen for students who mention the use of place value or place value relationships.

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions around very large numbers.

Check Your Understanding

1. Use the digits 3, 5, 7, 8, 8, 1, 6, 2 to make the greatest number you can. Then use the same digits to make the smallest number you can.
   Greatest: 88,765,321
   Smallest: 12,356,788
2. How did the value of the 2 change from your greatest number to your smallest number? Why did it change? Use words and numbers to explain your thinking.
   If students answered Question 1 correctly, they should recognize that the 2 has a value of 20 in the largest number, but a value of 2,000,000 in the smallest number. The value changed because the location of the digit changed.
3. How are 23,450 and 230,450 similar? How are they different? Use words and numbers to explain your thinking.
   Students may recognize that the two numbers have similar digits except the second numeral has a 0 in the Thousands place, making the number much larger.
4. List three possible values for the digit 5.
   Answers should include three of the following: 5, 50, 500, 5,000, 50,000, 500,000, 5,000,000, 50,000,000, 500,000,000, and 5,000,000,000.

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LESSON 3
Changing Values

Lesson Overview

In this lesson, students deepen their knowledge of place value. They build on what they learned in Lesson 2 and begin to develop understanding that a digit's value changes as it moves to the left within a numeral. They analyze and describe patterns they see in changing values as they begin to investigate relationships between place values.

Lesson Essential Question

- How does the value of a digit change as it moves one place to the left within a whole number?

Learning Objectives

In this lesson

- Students will explain how the value of a digit changes as it moves to the left in a whole number.
- Students will describe patterns they observe in changing place values.

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

4.C.1.a Interpret a multiplication equation as a comparison (for example, $42 = 7 \times 6$ as a statement that 42 is 7 times as many as 6).

Vocabulary Check-In

amateur, milliard, myrmecologist, period, place value

Materials List

- Place value chart (Project or re-create on board)
- Digit cards 0–9 (1 set per student)
- Scissors (1 per student)

Preparation

Keep the digit cards for future lessons.

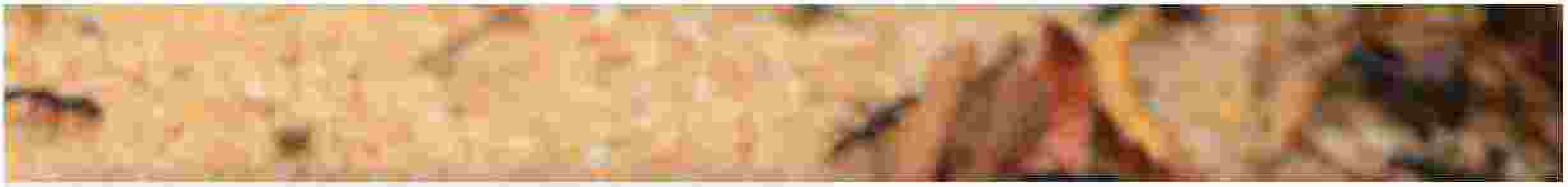
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Lesson 3
Changing Values

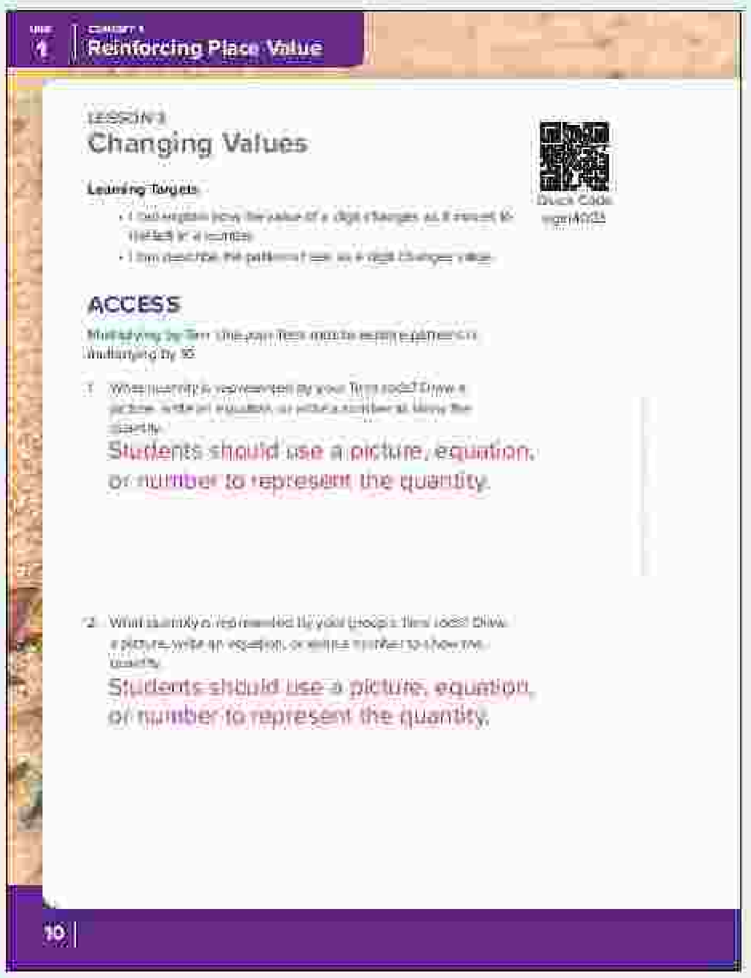
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Student Page 10



UNIT 1 | Reinforcing Place Value

LESSON 3

Changing Values

Learning Targets

ACCESS

1. Students should use a picture, equation, or number to represent the quantity.

2. Students should use a picture, equation, or number to represent the quantity.

10

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may be able to identify the place values and periods but may not recognize the pattern or relationship between each place.

Multiplying by Ten

1. Distribute 2 Tens rods to each student.
2. Direct students to Lesson 3 ACCESS Multiplying by Ten. Ask students to read the directions and answer the first question.
3. Help students to form small groups (Shoulder Partners or larger groups). Direct students to work together to determine the quantity they have as a group and answer the second question.

   TEACHER NOTE: This experience can serve as a formative assessment. Notice how students represent what they have independently and in small groups. Who draws? Who uses addition (10 + 10) to represent? Who uses multiplication (10 × 2) to represent? Find several students who have different strategies and ask them to share with the whole group.

4. Solve several problems together using multiplication by 10. Record on the board. For example:
   - If 5 people were in the small group, how many would there be? How do you know? (5 × 10 = 50)
   - If 11 people were in the small group, how many would there be? How do you know? (11 × 10 = 110)
   - How many are there in our whole class? How do you know? Answers will depend on how many students are in the class.
5. Ask students to discuss any patterns they observe in the multiplication problems.

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TEACHER NOTE: Some students may recognize that when they multiply a number by 10, they can simply add a 0 to the number to get the product. It is okay if students do not yet recognize that pattern. They are not expected to apply it at this time.

BUILD (40 min)

What Is My Value? (15 min)

1. Display the Lesson 3 Essential Question. Ask students to read and think about the question: *How does the value of a digit change as it moves one place to the left within a whole number?*

2. Ask volunteers to share their ideas. At this time, do not correct any misconceptions.

3. Select a digit card (1–9) and hold it up. Ask the following questions and have students respond chorally:

   ASK
   - *What value does this digit have when I put it in the Ones place?*
   - *What value does this digit have when I put it in the Tens place?*

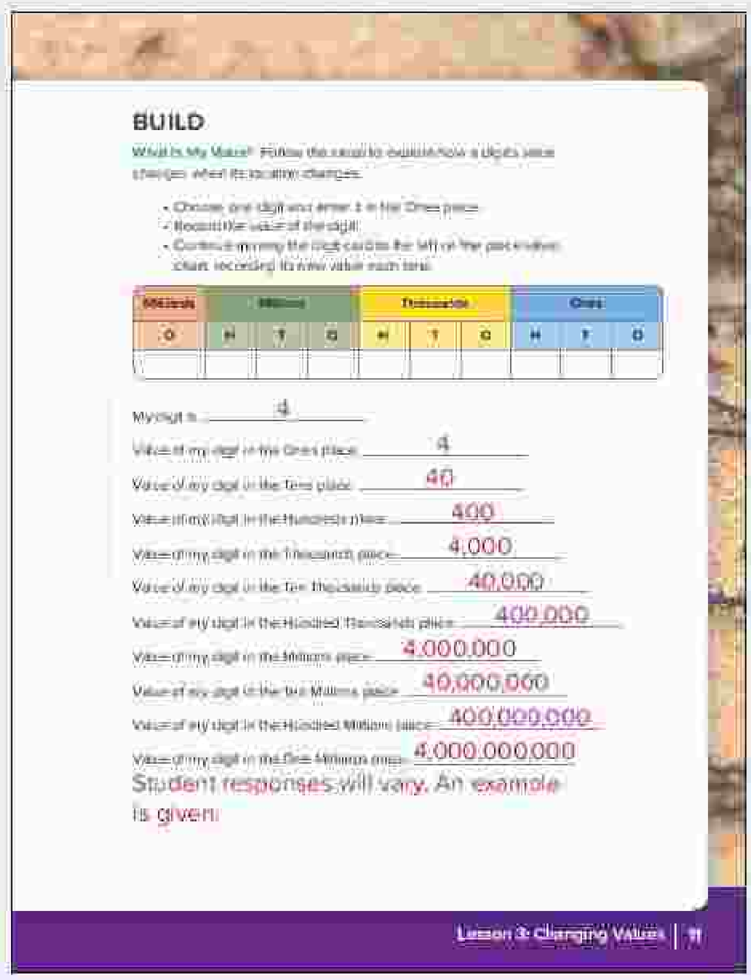
   TEACHER NOTE: Continue modeling this movement with the questions for as many place values as the class needs to answer the questions with confidence. Students do this work independently next, so ensure they understand the concept of changing value.

4. Direct students to Lesson 3 BUILD What Is My Value? Ask students to repeat the activity on their own with a digit of their choice.
   Answers will vary, but students should write down the digit they selected and the correct number of zeroes.

5. Ask students to talk to a Shoulder Partner about the Essential Question. Then, ask students to share with the whole group what they now know about the Essential Question.
   The value of a digit gets larger as it moves to the left. Students may already notice that it gets larger by "ten times." This will be reinforced in the next learning experience.

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Student Page 11



BUILD

What Is My Value? Follow the steps to explore how a digit's value changes when its location changes.

- Choose one digit and enter it in the Ones place.
- Record the value of the digit.
- Continue moving the digit one place to the left on the place value chart, recording its new value each time.

Billions	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

My digit is 4

Value of my digit in the Ones place 4

Value of my digit in the Tens place 40

Value of my digit in the Hundreds place 400

Value of my digit in the Thousands place 4,000

Value of my digit in the Ten Thousands place 40,000

Value of my digit in the Hundred Thousands place 400,000

Value of my digit in the Millions place 4,000,000

Value of my digit in the Ten Millions place 40,000,000

Value of my digit in the Hundred Millions place 400,000,000

Value of my digit in the One Billions place 4,000,000,000

Student responses will vary. An example is given.

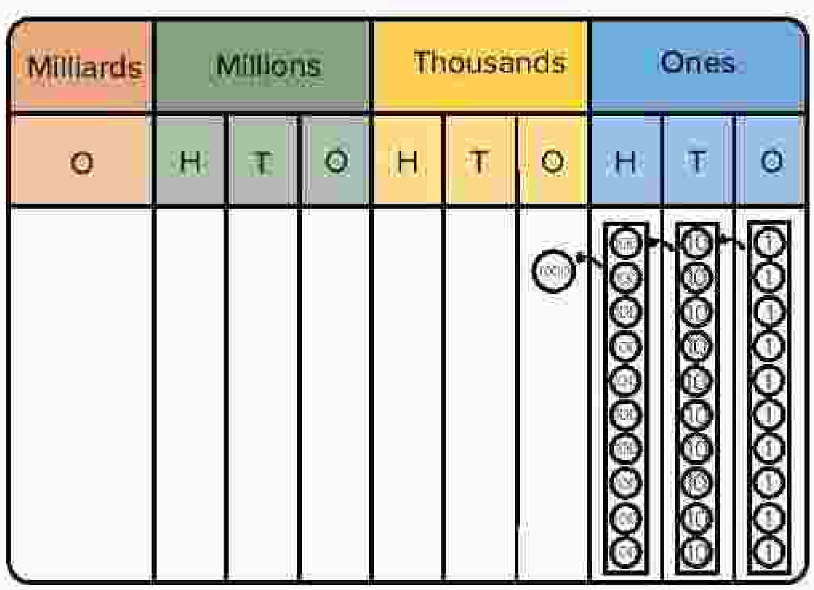
Lesson 3: Changing Values | 11

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Exploring Place Value Relationships (25 min)

TEACHER NOTE: Multiplying by tens and multiplicative comparisons are important concepts for Primary 4 students. Students should notice that each place to the left is multiplied by 10. If they do not notice this on their own, point it out and then ask students to confirm this is true. The statements in step 8 below help introduce this with mathematical language. These concepts will be reinforced several times in Primary 4.

1. Remind students that in earlier grades, they used Base Ten Blocks, or Hundreds, Tens, and Ones manipulatives. Ask students to talk to their Shoulder Partner about what they remember about this math tool. Explain to students that they are going to use drawings to represent numbers.
2. Display the place value chart. Draw one circle with the number 1 inside. Ask students to count aloud with you as you draw more circles. Stop when you reach 10.
3. Ask students what happens when they get 10 Ones in the Ones place.
   They make one Ten. When they get to 10 Ones, they should regroup them and move them to the Tens place.
4. Draw a box around the 10 Ones to represent regrouping and draw an arrow to the Tens place to represent moving the new group to the Tens place.
5. In the Tens column, draw one circle with the number 10 inside. Ask students to count aloud with you as you draw more circles. Stop when you reach 100.
6. Ask students what happens when they get 10 Tens in the Tens place.
   Students should know that they make one Hundred and that they should regroup them and move them to the Hundreds place.
7. Draw a box around the 10 Tens to represent regrouping and draw an arrow to the Hundreds place to represent moving the new group to the Hundreds place.
8. Repeat this process with the Hundreds place. (See the example that follows.)

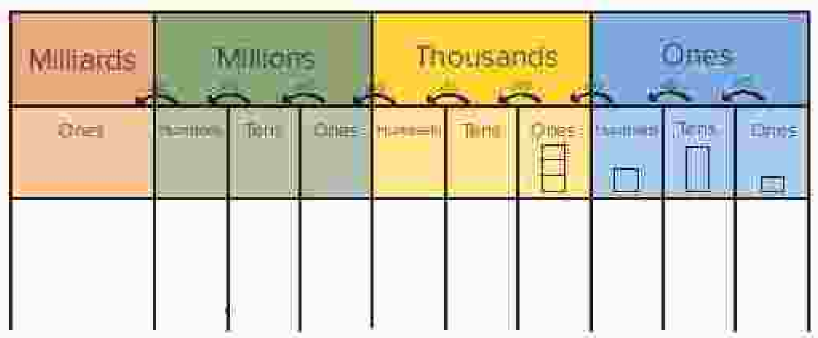


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9. Ask students to talk to their Shoulder Partner about the pattern they notice. Reinforce that each time we move to the left in a numeral, the value of digits gets 10 times larger. If necessary, write the following on the board: 10 × 1 = 10, 10 × 10 = 100, 10 × 100 = 1,000.

10. Direct students to BUILD Exploring Place Value Relationships. Write on the place value chart on the board to show that each place increases in value 10 times as they move to the left. (See example that follows). Have students record the same information.
Students should use arrows or other indicators to show that the value increases 10 times with each move to the left.

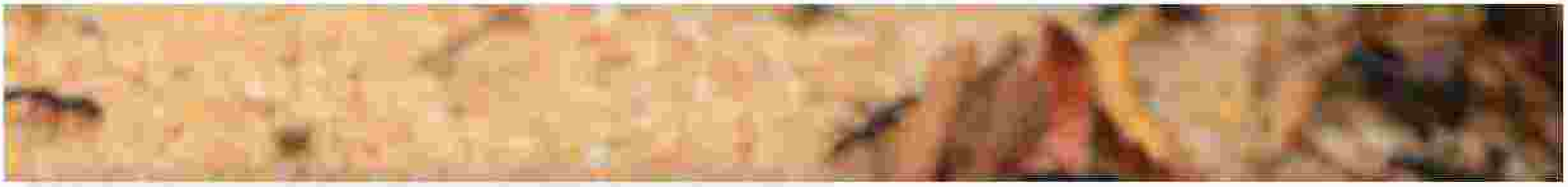
11. Ask students to answer the question in the Student Materials: As a digit moves one space to the left on the place value chart, its value increases by 10 times.



12. Reinforce by recording the following on the board and reciting the pattern chorally. Repeat as many times as needed to help students understand. Ask students to discuss the patterns they see in the answers.
Students should mention patterns related to the number of zeroes in the answers.

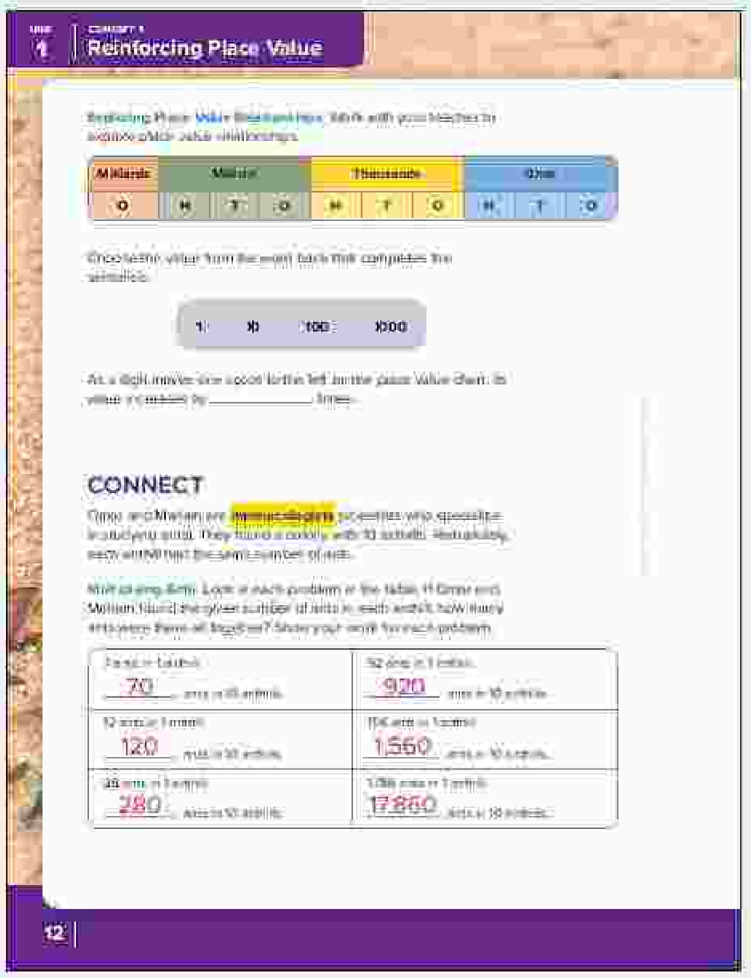
- 1 Ten is 10 times as much as 1 One. 10 × 1 = 10
- 1 Hundred is 10 times as much as 1 Ten. 10 × 10 = 100
- 1 Thousand is 10 times as much as 1 Hundred. 10 × 100 = 1,000
- 1 Ten Thousand is 10 times as much as 1 Thousand. 10 × 1,000 = 10,000
- 1 Hundred Thousand is 10 times as much as 1 Ten Thousand. 10 × 10,000 = 100,000
- 1 Million is 10 times as much as 1 Hundred Thousand. 10 × 100,000 = 1,000,000
- 1 Ten Million is 10 times as much as 1 Million. 10 × 1,000,000 = 10,000,000
- 1 Hundred Million is 10 times as much as 1 Ten Million. 10 × 10,000,000 = 100,000,000
- 1 Milliard is 10 times as much as 1 Hundred Million. 10 × 100,000,000 = 1,000,000,000

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Reinforcing Place Value

Millions				Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

1 10 100 1000

CONNECT

70	920
120	1,560
280	17,860

12

CONNECT (7 min)

Multiplying Ants

Direct students to Lesson 3 CONNECT Multiplying Ants and ask them to complete the learning activity.

WRAP-UP (3 min)

Let's Chat About Our Learning

Go over the answers to the CONNECT activity Multiplying Ants with students. Then, ask volunteers to share their strategies for solving the problems.

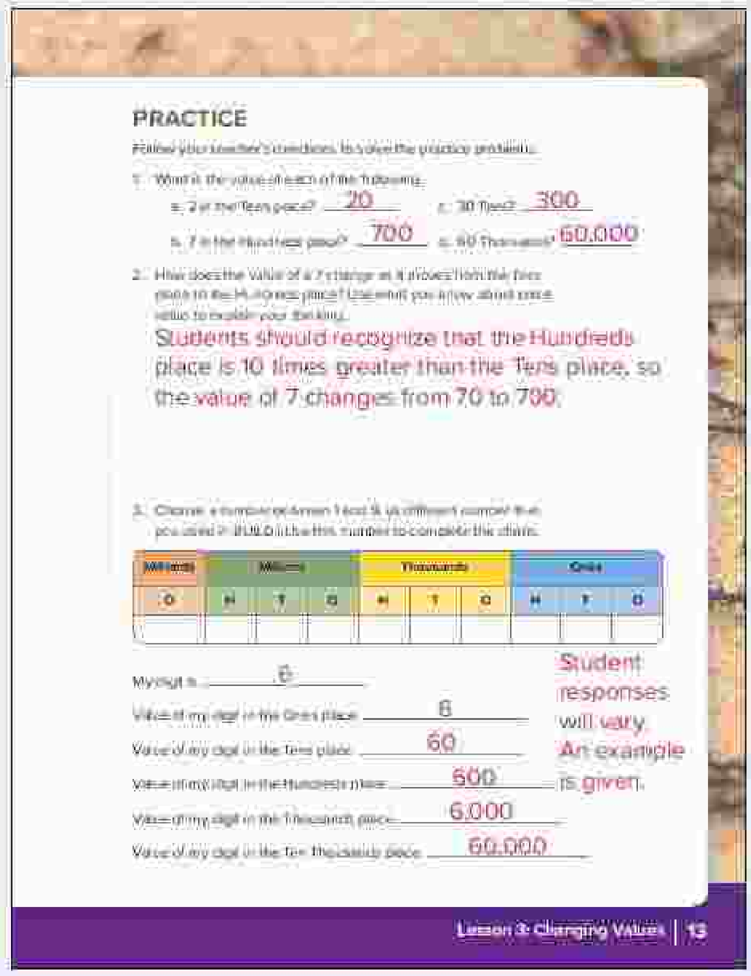
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PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions around changing values.

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PRACTICE

Follow your teacher's directions to solve the practice problems.

1. What is the value of each of the following:
   a. 2 in the Tens place? 20
   b. 7 in the Hundreds place? 700
   c. 30 Tens? 300
   d. 60 Thousands? 60,000
2. How does the value of a 7 change as it moves from the Tens place to the Hundreds place? Use what you know about place value to explain your thinking.
   Students should recognize that the Hundreds place is 10 times greater than the Tens place, so the value of 7 changes from 70 to 700.
3. Choose a number between 1 and 9 (a different number than you used in BUILD). Use this number to complete the chart.

Billions	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

My digit is 6

Value of my digit in the Ones place 6

Value of my digit in the Tens place 60

Value of my digit in the Hundreds place 600

Value of my digit in the Thousands place 6,000

Value of my digit in the Ten Thousands place 60,000

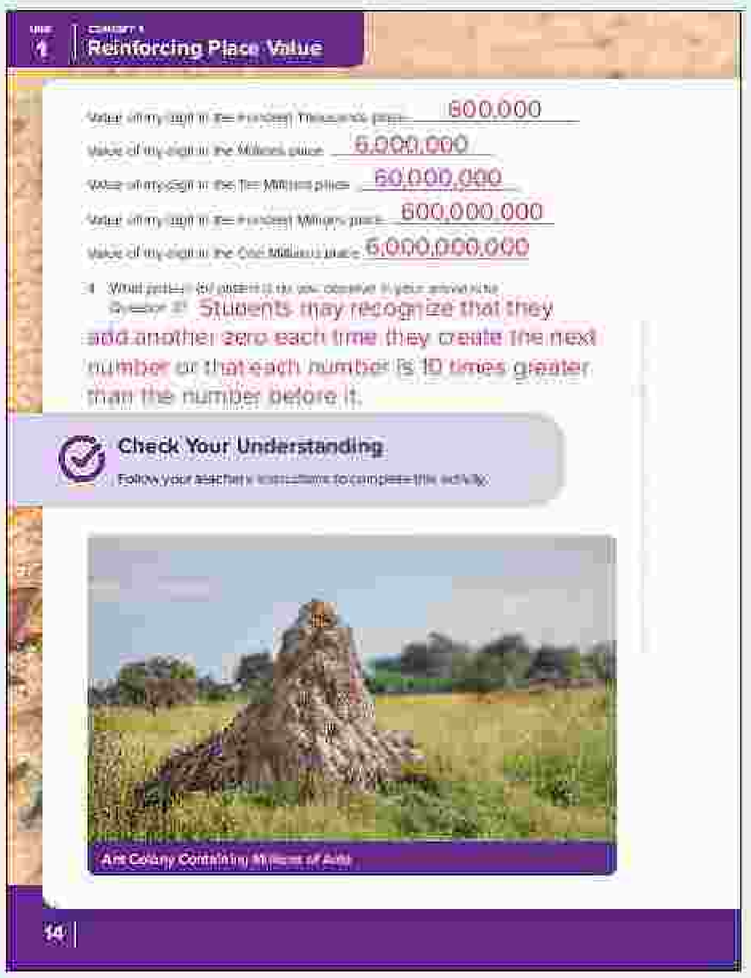
Student responses will vary. An example is given.

Lesson 3: Changing Values | 13

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UNIT 1 | CONCEPT 1
Reinforcing Place Value

Value of my digit in the Hundred Thousands place 600,000

Value of my digit in the Millions place 6,000,000

Value of my digit in the Ten Millions place 60,000,000

Value of my digit in the Hundred Millions place 600,000,000

Value of my digit in the One Billions place 6,000,000,000

4. What pattern (or patterns) do you observe in your answers to Question 3? Students may recognize that they add another zero each time they create the next number or that each number is 10 times greater than the number before it.

Check Your Understanding
Follow your teacher's instructions to complete this activity.

Ant Colony Containing Millions of Ants

14

Check Your Understanding

1. Fill in the blanks below.
   One million/1,000,000 is 10 times greater than one hundred thousand.
   Two thousand/2,000 is 10 times greater than two hundred.
   Seventy thousand/70,000 is 10 times greater than seven thousand.

2. What is the value of the following:
   a. 9 in the Tens place? 90
   b. 3 in the Hundreds place? 300
   c. 60 Tens? 600
   d. 80 Thousands? 80,000

3. How does the value of a 3 change as it moves from the Hundreds place to the Thousands place? Use what you know about place value to explain your thinking.
   Students should recognize that the Thousands place is 10 times greater than the Hundreds place, so the value of 3 changes from 300 to 3,000.

4. Choose a number between 1 and 9. (Choose a different number than you used in BUILD and PRACTICE.)
   See BUILD for sample answer.

5. What pattern (or patterns) do you observe in your answers to Question 3?
   Students may recognize that they add another zero each time they create the next number or that each number is 10 times greater than the number before it.

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LESSON 4
Review Comparing Values

Lesson Overview

In this lesson, students connect their understanding of place value to multiplicative comparisons. They solidify their understanding that a place value to the left of another is 10 times greater.

Lesson Essential Question

- How does the value of a digit change as it moves one place to the left within a whole number?

Learning Objectives

In this lesson

- Students will explain the relationship between a given place value and the place value to its left.
- Students will use multiplication to compare place values.

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

4.C.1.a Interpret a multiplication equation as a comparison (for example, $42 = 7 \times 6$ as a statement that 42 is 7 times as many as 6).

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Place Value Chart through the One Milliard place (Display on board)
- Base Ten Blocks or place value manipulatives plus 1 large set for the teacher
- Digit Cards 1–9 (1 set per student) (from Lesson 2)
- Large Digit Cards 1–9 (1 set for the teacher)

Preparation

Photocopy the Blackline Masters for the Large Digit cards 1–9 and the Base Ten Manipulatives at the end of this volume. Allow time for students to cut out the manipulatives or have them do it for homework prior to this lesson. Store manipulatives for future use.

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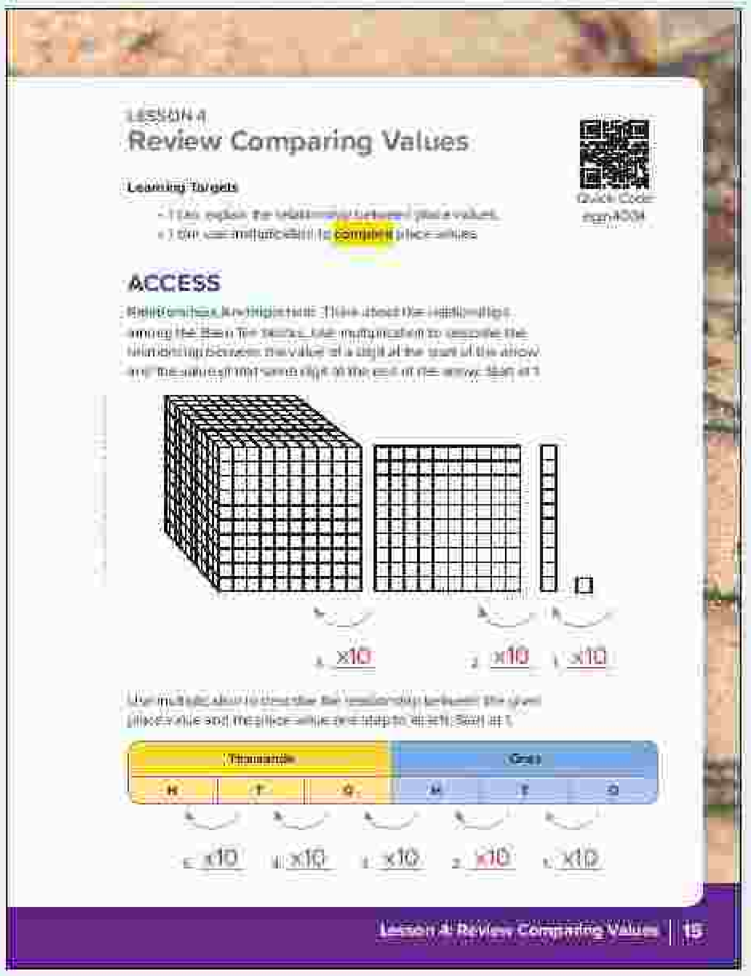
Lesson 4
Review Comparing Values

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may be able to identify the place values and periods, but may not recognize the pattern or relationship between each place.

Relationships Are Important!

1. Direct students to Lesson 4 ACCESS Relationships Are Important! Make sure students understand the directions, then have them begin working. (This learning activity is a review of their learning in Lesson 3.)

   TEACHER NOTE: Students may work independently, in pairs, in small groups, or as a whole group with you, depending on how well they understand the learning activity. This activity may also serve as a formative assessment to determine who will need extra support to meet the learning objectives for this lesson.

2. After about 5 minutes, ask student volunteers to share their answers and explain their thinking. Each number or place is 10 times greater than the number or place to its right. Students should write ×10 in each blank.

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BUILD (40 min)

Exploring Place Value Relationships (15 min)

1. Remind students that they have already learned that the value of a digit depends on its location within a number. Explain that they should also know that it can be helpful to understand the relationship between a given place value and the place value to its left.

2. Ask students to describe the patterns they saw in the ACCESS problems. Students should describe a pattern of multiplying by 10 each time they move one place to the left.

3. Tell students that, when we understand these relationships, we understand why we can write large numerals using only one digit. Write the numeral 555,555 on the board. Circle the 5 in the Tens place and draw an arrow to the 5 in the Hundreds place. Ask students to explain the relationship between the values of the two fives. Record their thinking on the board. The value of the 5 in the Hundreds place is 10 times greater than the value of the 5 in the Tens place. Some students may say that the value of the 5 in the Tens place is 10 times less than the value of the 5 in the Hundreds place. This is also correct.

4. Explain that there are also important relationships across place values, even when we cannot see them. Direct students to Lesson 4 BUILD Exploring Place Value Relationships.

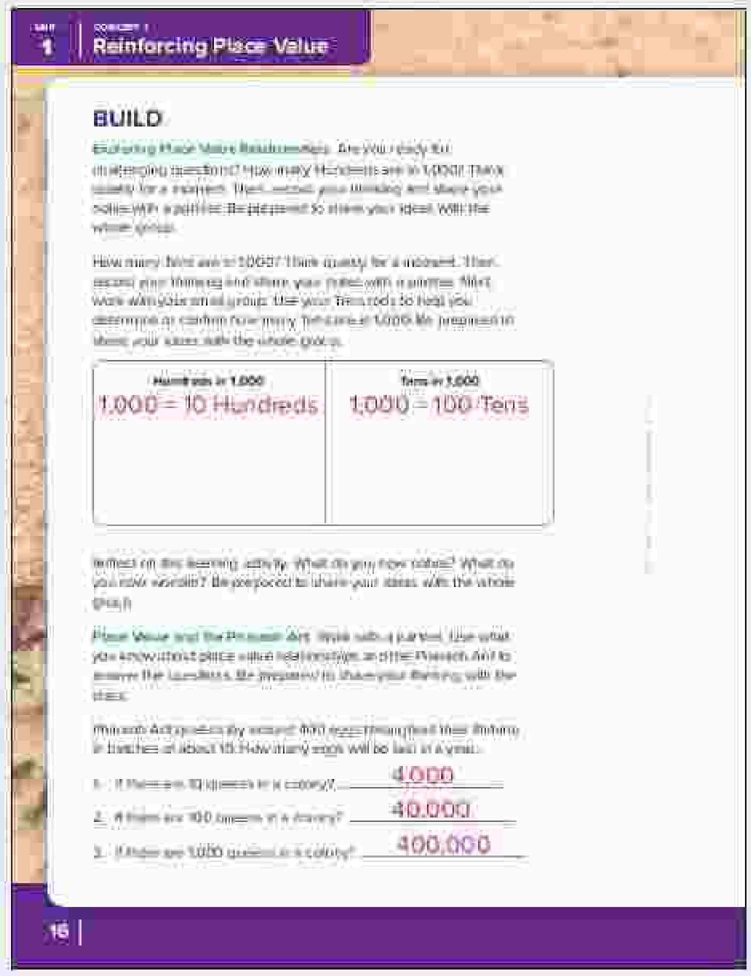
5. Write the numeral 1,000 on the board and ask students how many Hundreds are in the numeral 1,000. Encourage students to think quietly before answering, then have them share their thinking with a partner.

6. Ask volunteers to share their thinking. (At this time, many students will say there are zero Hundreds in 1,000 because they are focused on a strict reading of the place value chart.)

7. If no students recognize that there are 10 Hundreds in 1,000, have them count aloud with you as you display and count 10 Hundreds manipulatives. Record 1,000 = 10 Hundreds.

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Student Page 16

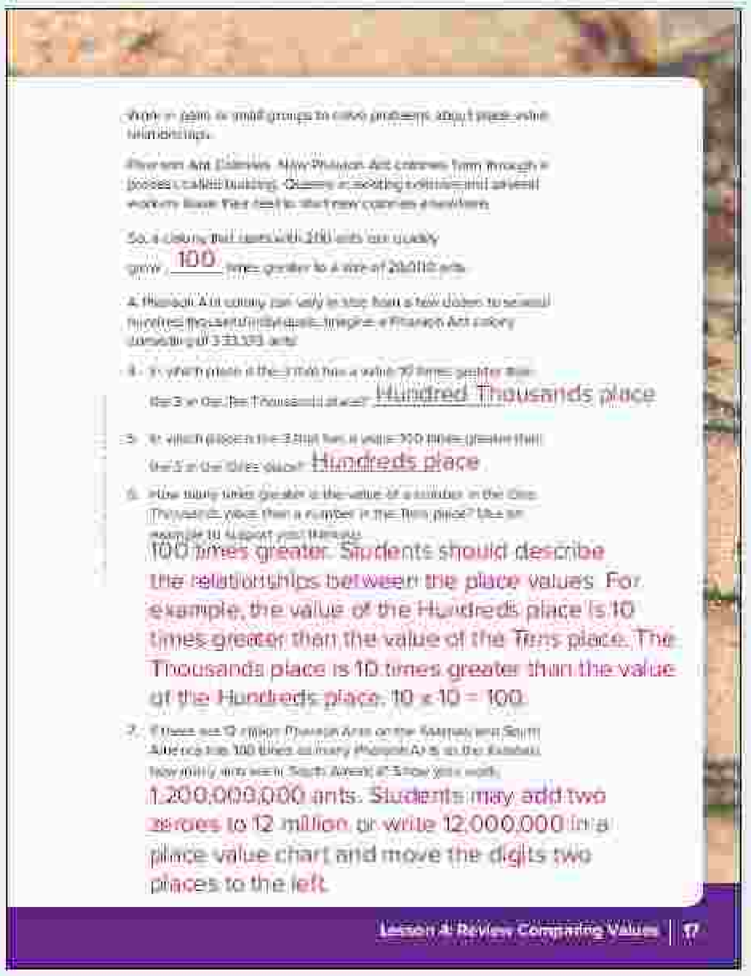


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So, a colony that starts with 200 ants can quickly grow 100 times greater to a size of 20,000 ants.

4. In which place is the 3 that has a value 10 times greater than the 3 in the Ten Thousands place? Hundred Thousands place

5. In which place is the 3 that has a value 100 times greater than the 3 in the Ones place? Hundreds place

6. 100 times greater. Students should describe the relationships between the place values. For example, the value of the Hundreds place is 10 times greater than the value of the Tens place. The Thousands place is 10 times greater than the value of the Hundreds place. 10 x 10 = 100.

7. 1,200,000,000 ants. Students may add two zeroes to 12 million or write 12,000,000 in a place value chart and move the digits two places to the left.

Lesson 4: Review Comparing Values | 17

8. Ask students how many Tens are in 1,000. Allow time for them to think and share their answers with a Shoulder Partner. (At this time, some students may recognize that there are 100 Tens in 1,000.)
9. Have students work in small groups to combine their Tens rods to create 1,000 and confirm how many Tens are in 1,000.
10. After a few minutes, regroup students and ask them to share their findings. Record 1,000 = 100 Tens on the board.
11. Ask students to consider the numbers they have seen today as they have worked on place value concepts. What do they notice? What do they wonder? Allow time for students to share their thinking. (Some students may recognize that they have been working with multiples of 10. Confirm this thinking. Ask questions to guide students' thinking if they do not mention this.)

Place Value and the Pharaoh Ant (25 min)

1. Direct students to Lesson 4 BUILD Place Value and the Pharaoh Ant and ask them to work in pairs to solve Problems 1–3.
2. Ask volunteers to share their thinking and ask them how these problems relate to what we know about relationships between place values.
3. Have students work in pairs or small groups to complete Problems 4–7 in BUILD.

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CONNECT (5 min)

Step to the Left

Have students turn to Lesson 4 CONNECT Step to the Left. Go over the directions with students and have them work independently to complete the activity, which relates to the Essential Question for this lesson.

TEACHER NOTE: Consider reviewing students' answers after class to determine whether or not they understand the relationships between place values, specifically as a digit moves left on the place value chart. Some students may need additional support.

WRAP-UP (5 min)

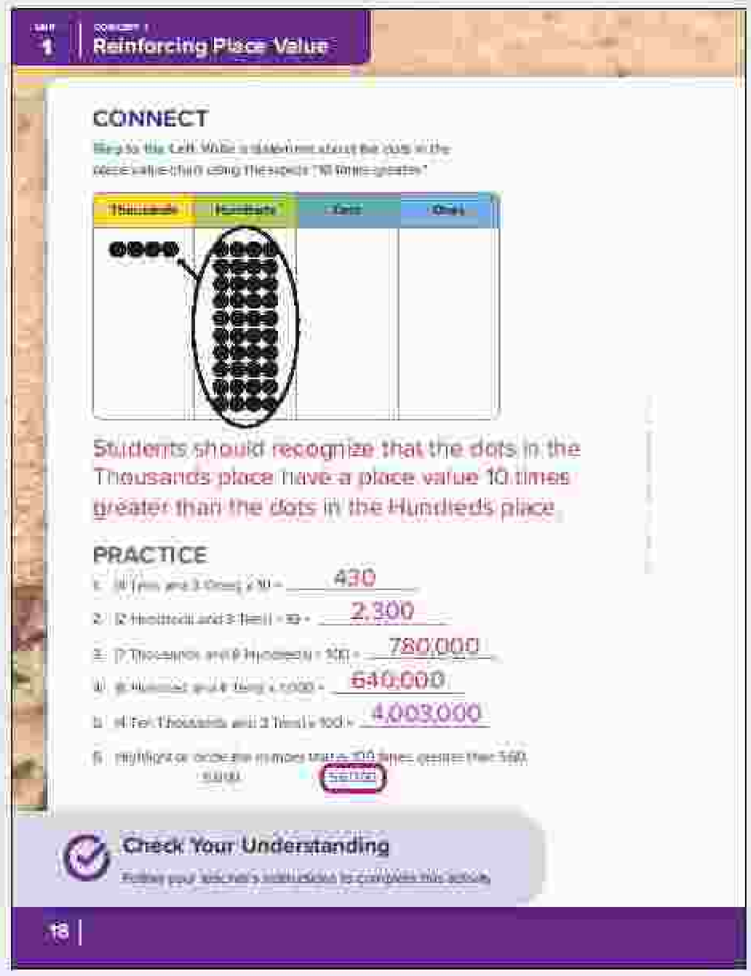
Let's Chat About Our Learning

1. Ask volunteers to share their answers to the BUILD and CONNECT problems. If time allows, have students model and explain their thinking for the problems the class found most challenging.
2. Ask students to Turn and Talk about how a digit's value changes as it moves to the left on the place value chart. Ask a few students to share their thinking. Then ask students to Turn and Talk about what might be a true statement about how the digit's value changes when it moves to the right on the place value chart.
   The value of the digit increases by 10 times (or becomes 10 times greater) as it moves from one place to the next on the place value chart.

   TEACHER NOTE: The concept of "10 times smaller" will be explored in depth in Primary 5. The purpose of this discussion is to get students to really think about the patterns they are observing rather than to know the correct answer.

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Student Page 18



PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. (3 Tens and 9 Ones) × 10 = 390
2. (5 Thousands and 2 Hundreds) × 100 = 520,000
3. (9 Hundred and 9 Tens) × 1,000 = 990,000
4. 56 Thousands × 100 = 5,600,000
5. Highlight or circle the number that is 100 times larger than 42.
   420 or 4,200
6. Highlight or circle the number that is 1,000 times larger than 123.
   123,000 or 12,300
7. Akilah said that there are 300 Hundreds in 3,000. Do you agree or disagree? Use what you have learned about place value to explain your thinking.
   Disagree. Answers may vary, but students should indicate that 300 Hundreds is 30,000, not 3,000. There are 30 Hundreds in 3,000.

LESSON 5
Many Ways to Write

Lesson Overview

In this lesson, students write numbers to the One Milliard place in standard, expanded, and word form by generating their own numbers with number cards. They create the greatest possible number with given digits and then compare with a partner, analyzing specific place values with their partner. Finally, students reflect on how writing in expanded notation shows the true value of a number.

Lesson Essential Questions

- How can numbers be broken apart?
- How does breaking numbers apart help us understand them?

Learning Objectives

In this lesson

- Students will write numerals in standard, word, and expanded forms.

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.C.1 Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

Vocabulary Check-In

expanded form, standard form, word form

Materials List

- Digit Cards 0–9 (1 per student) (from Lesson 2)

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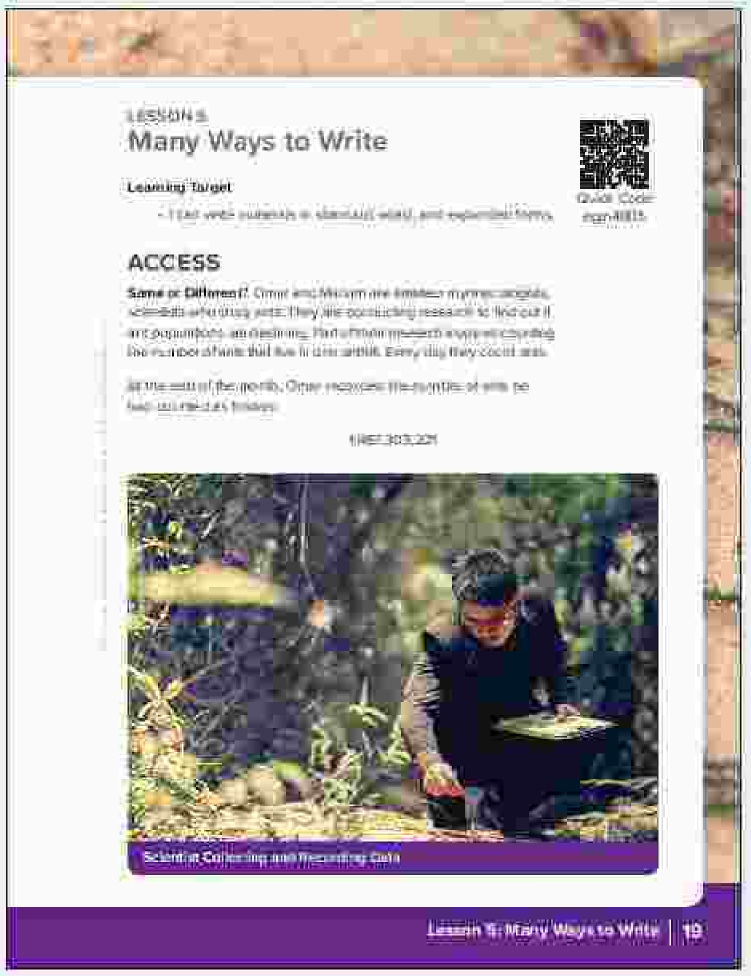


Lesson 5
Many Ways to Write

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LESSON 5

Many Ways to Write

Learning Target

ACCESS

Scientist Collecting and Recording Data

Lesson 5: Many Ways to Write | 19

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused about how to represent a place value with a 0 digit in expanded form. For example: 30,456 = 30,000 + 400 + 50 + 6. The 0 is not represented in expanded form because in standard form the 0 represents that there is nothing in that place value.
- Students may struggle to say large numbers and need to be reminded to group the numbers into periods as they read them aloud.
- Students may forget to use commas when writing numbers in word form.

Same or Different?

1. Direct students to Lesson 5 ACCESS Same or Different. Ask students to read the scenario independently.
2. Ask a volunteer to read the number of ants Omar counted. Ask another volunteer to read the number of ants Mariam counted.
3. Have students explain to their Shoulder Partner whether they think Omar and Mariam counted the same number of ants or a different number and explain to their partner how they know.
   Omar and Mariam counted the same number of ants. Students may discuss using place value, reading the numbers aloud, or writing them in a place value chart and compared them. The difference between the two numbers is that Omar's is written in standard form and Mariam's is written in expanded form.
4. Ask volunteers to share their thinking with the whole group. Ask follow-up questions, such as the following:

ASK

- *How do you know?*
- *Is there a way to be sure they are the same (or different)?*
- *What is the same about these numbers?*
- *What is different?*

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BUILD (40 min)

Numeral Form Exploration (10 min)

1. Direct students to Lesson 5 BUILD Numeral Form Exploration section of their Student Materials. Show students the number 9,231,043,204 written in standard form, expanded form, and word form. Read the numbers aloud with students.

2. Ask students to share their thinking about the following questions.

ASK
- *What do you remember about these forms of writing numerals?*
- *What was easy?*
- *What was challenging?*

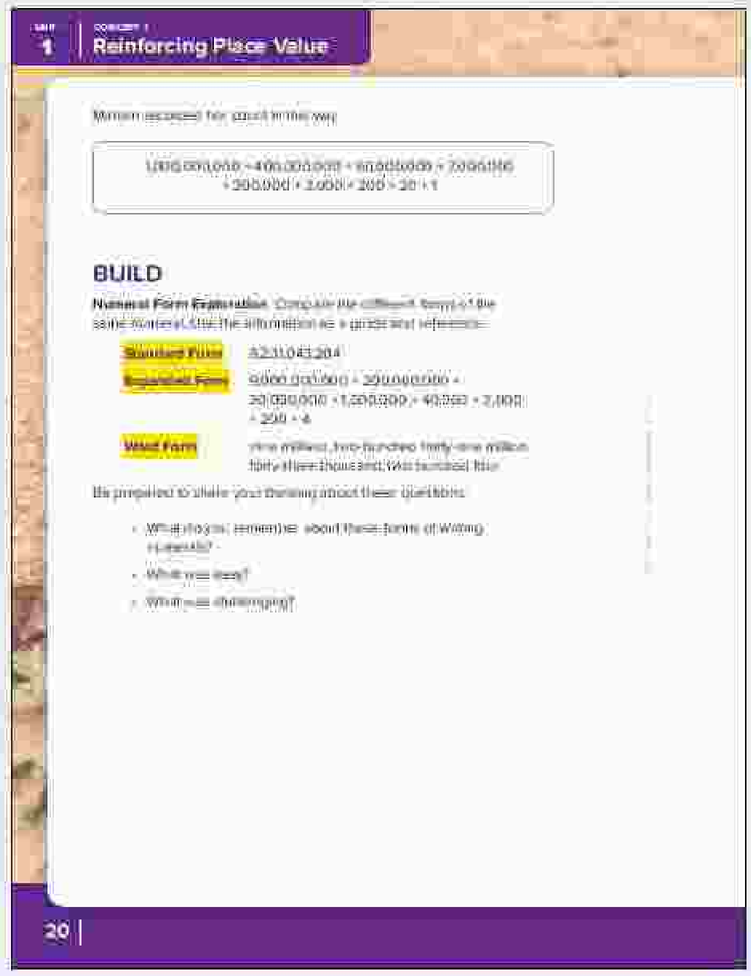
3. Explain that in mathematics, we use the standard form most often. Numbers are also frequently written in word form. Expanded form helps us recognize that digits are placeholders representing the Ones, Tens, Hundreds, Thousands, Ten Thousands, Hundred Thousands, and so on. Numbers written in expanded form show their full value.

4. Point to the 0s in the Hundred Thousands and Tens places. Ask students how these are represented in expanded notation. Explain that zeroes are not needed in expanded notation because there is nothing in that place value. If students struggle with the concept, write several examples of this in standard form and expanded form on the board.

5. Point to the commas in standard form and note that they are also used in word form to separate the Milliard, Millions, Thousands, and Ones periods.

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UNIT 1 | CONCEPT 1
Reinforcing Place Value

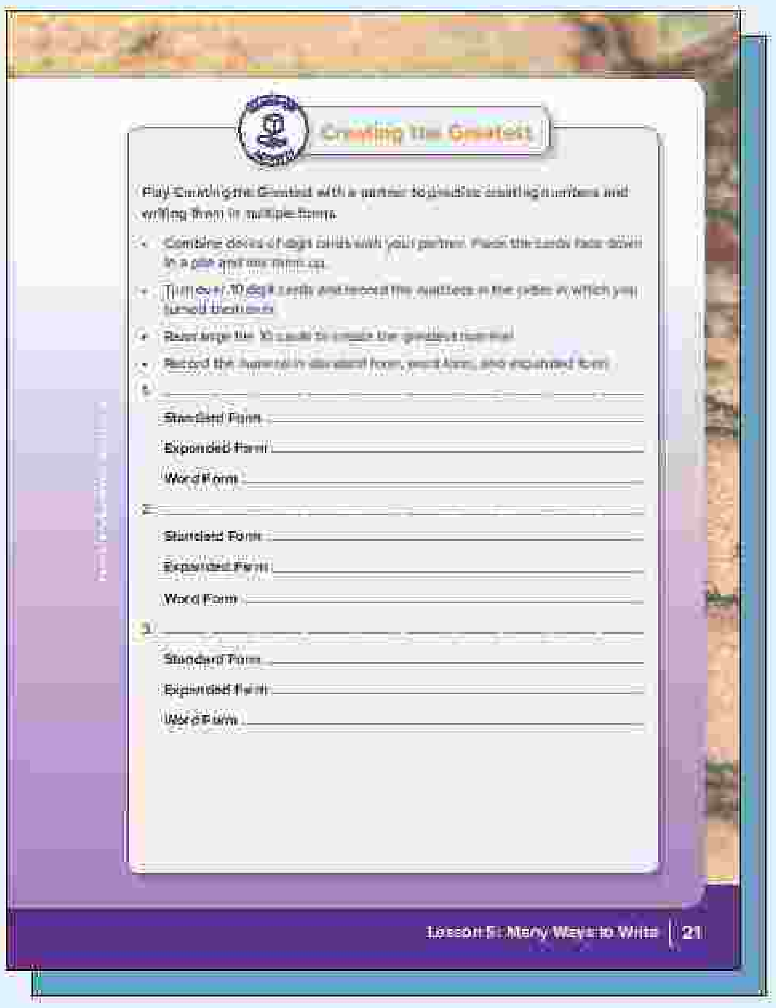
BUILD

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Student Pages 21–22


Creating the Greatest

Play Creating the Greatest with a partner to practice creating numbers and writing them in multiple forms.

- Combine decks of digit cards with your partner. Place the cards face down in a pile and mix them up.
- Turn over 10 digit cards and record the numbers in the order in which you turned them over.
- Rearrange the 10 cards to create the greatest numeral.
- Record the numeral in standard form, word form, and expanded form.

1. ______
   Standard Form ______
   Expanded Form ______
   Word Form ______
2. ______
   Standard Form ______
   Expanded Form ______
   Word Form ______
3. ______
   Standard Form ______
   Expanded Form ______
   Word Form ______

Lesson 5: Many Ways to Write | 21

Creating the Greatest (30 min)

1. Direct students to Lesson 5 BUILD Creating the Greatest. Go over the directions for Creating the Greatest together. Model game play, if necessary. Students will need their digit cards 0–9 to play.
2. Give students about 20 minutes to play the game with their Shoulder Partner. As students work, walk around and monitor their game play to make sure they are following the directions. Offer support as needed.

   TEACHER NOTE If time allows, also ask students to create the smallest numerals possible.

3. After 20 minutes, ask students to compare their greatest numeral with that of their Shoulder Partner. Ask student pairs the following questions:

   ASK
   - *Which of you has the greatest numeral?*
   - *Which of you has the greatest digit in the Ten Thousands place?*
   - *Which of you has the smallest digit in the One Milliards place?*
   - *Which of you has the smallest digit in the Ten Thousands place?*

4. Ask students to share their strategies for writing large numbers in different forms.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 5 CONNECT Writing About Math and ask them to respond to the prompt.
Students should have used place value and an understanding of the value of each digit to create the greatest numbers possible. For example, it would not make sense to write the smallest digit in the highest place, since that would not allow you to create the greatest numeral possible. Students should recognize that they should write the greatest digit in the greatest place and list them in decreasing value in the numeral they create.

TEACHER NOTE: Instead of having students share their responses in WRAP-UP, consider using students' journal entries as a formative assessment to evaluate whether or not they understand and can apply place value concepts. Use WRAP-UP as an opportunity for students to model the strategies they used to solve the BUILD problems.

WRAP-UP (3 min)

Let's Chat About Our Learning

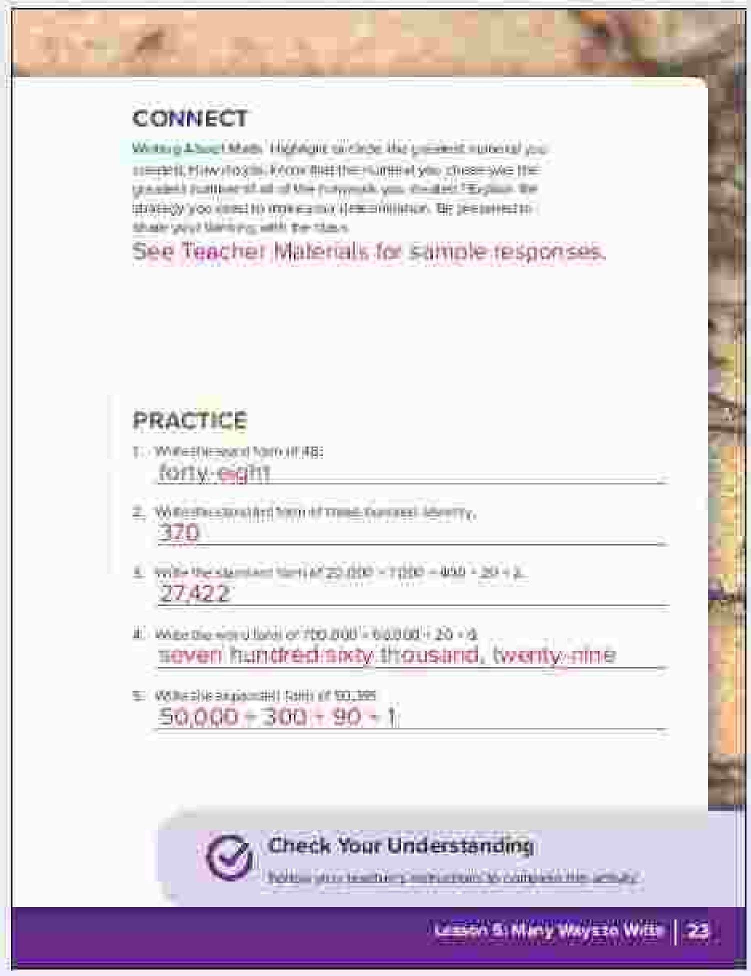
1. Ask a few student volunteers to share their Writing About Math entries.
2. Ask students to explain how writing numbers in expanded form can help them understand really big numbers. Encourage students to use mathematical language in their explanations.
   Students should note that expanded form helps them to see the value of each digit in a large number and helps them better understand place value.

PRACTICE

Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions around the many ways to write numbers.

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Student Page 23



CONNECT

Writing About Math Highlight or circle the greatest numeral you created. How do you know that the numeral you chose was the greatest number of all of the numerals you created? Explain the strategy you used to make your determination. Be prepared to share your thinking with the class.

See Teacher Materials for sample responses.

PRACTICE

1. Write the word form of 48.
   forty-eight
2. Write the standard form of three hundred seventy.
   370
3. Write the standard form of 20,000 + 7,000 + 400 + 20 + 2.
   27,422
4. Write the word form of 700,000 + 60,000 + 20 + 9.
   seven hundred sixty thousand, twenty-nine
5. Write the expanded form of 50,391.
   50,000 + 300 + 90 + 1

Check Your Understanding

Follow your teacher's instructions to complete the activity.

Lesson 5: Many Ways to Write | 23

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Check Your Understanding

Complete the table below:

	Standard Form	Expanded Form	Word Form
1	565	500 + 60 + 5	five hundred, sixty-five
2	4,706	4,000 + 700 + 6	four thousand, seven hundred six
3	2,345,222,197	2,000,000,000 + 300,000,000 + 40,000,000 + 5,000,000 + 200,000 + 20,000 + 2,000 + 100 + 90 + 7	two milliard, three hundred forty-five million, two hundred twenty-two thousand, one hundred ninety-seven
4	8,427,995,049	8,000,000,000 + 400,000,000 + 20,000,000 + 7,000,000 + 900,000 + 90,000 + 5,000 + 40 + 9	eight milliard, four hundred twenty-seven million, nine hundred ninety-five thousand, forty-nine
5	6,436,023,504	6,000,000,000 + 400,000,000 + 30,000,000 + 6,000,000 + 20,000 + 3,000 + 500 + 4	six milliard, four hundred thirty-six million, twenty-three thousand, five hundred four

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LESSON 6
Composing and Decomposing

Lesson Overview

In this lesson, students practice reading large numbers, and then work to understand the terms compose and decompose. They connect composing and decomposing numbers to the work they did in Lesson 5 as they decompose numerals using a combination of expanded form and multiplicative representations of place value.

Lesson Essential Questions

- How can numbers be broken apart?
- How does breaking numbers apart help us understand them?

Learning Objectives

In this lesson

- Students will compose and decompose numerals in multiple forms

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.C.1 Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

Vocabulary Check-In

compose, decompose, decomposed form, expanded form, standard form, word form

Materials List

- Place Value Chart through the One Milliard place (Display on board)
- We Have/Who Has? Cards (1 set) and Answer Key (for the teacher)

Preparation

Photocopy the Blackline Master at the end of this volume.

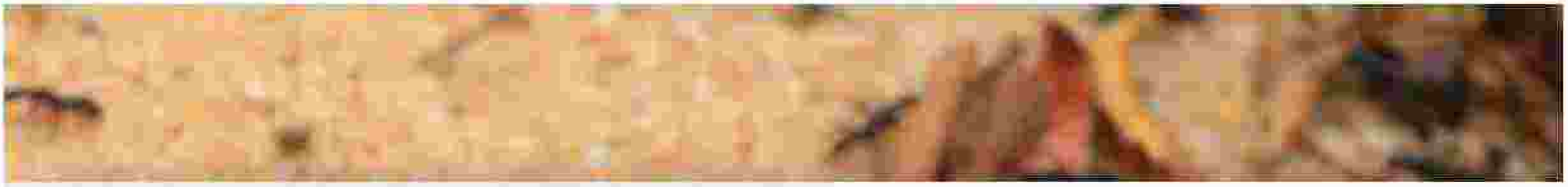
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Lesson 6
Composing and Decomposing

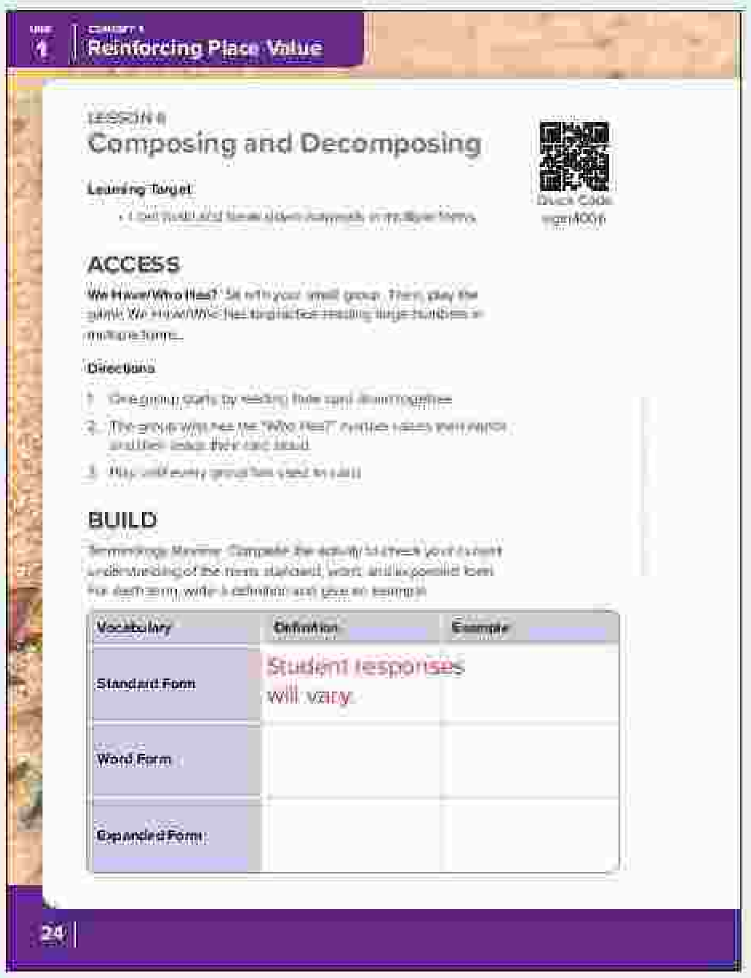
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UNIT 1 | Reinforcing Place Value

LESSON 6

Composing and Decomposing

Learning Target

Quick Code

ACCESS

Directions

BUILD

Vocabulary	Definition	Example
Standard Form	Student responses will vary.	
Word Form		
Expanded Form		

24

ACCESS (10 min)

> **COMMON MISCONCEPTIONS AND ERRORS**
>
> - Students may not be sure how to represent a zero in a place when the number is decomposed.
> - Students may incorrectly use parentheses to group place values.
> - Students may not connect digits in their place values, expanded notation, and decomposing numbers.
> - Students may confuse the terms *compose* and *decompose*.

We Have/Who Has?

1. Divide students into 16 small groups. Distribute one We Have/Who Has? card to each group.
2. Play the game as a warm-up and a review of learning in Lesson 5.

We Have/Who Has? Directions

- The group that has the card with the star starts by reading their card aloud together.
- The group who has the "Who Has?" number raises their hands and then reads their card aloud.
- Play until every group has used its card.

BUILD (40 min)

Terminology Review (10 min)

1. Direct students to Lesson 6 BUILD Terminology Review. Ask them to write definitions and give examples for standard form, expanded form, and word form.
2. Go over the glossary definitions as a class and have students add any necessary revisions.

Composing and Decomposing (2 min)

1. Ask students to talk to their Shoulder Partner and predict what might happen to an anthill after a strong wind or rain storm.

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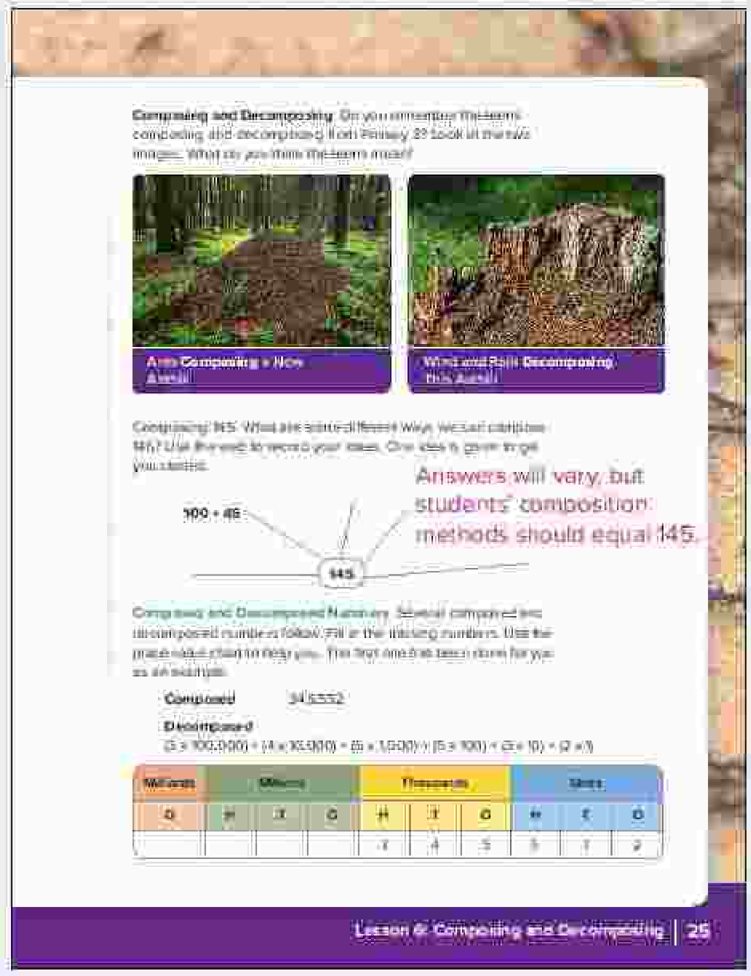
2. Direct students to Lesson 6 BUILD Composing and Decomposing. Ask students to look at the images of the anthills and briefly describe their observations.

Composing 145 (8 min)

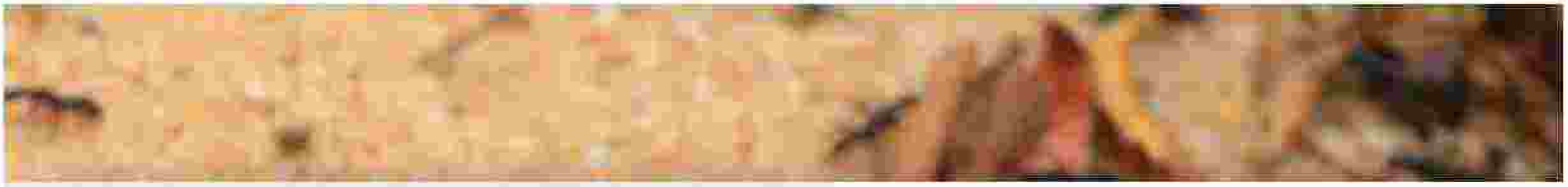
3. Explain that numbers, like an anthill, can be composed (put together) and decomposed (broken apart). Ask students to work independently to complete the activity Composing 145 in their Student Materials. Encourage students to use a variety of operations as they compose 145.
4. After a few minutes, tell students to share with a Shoulder Partner some of the ways they composed 145.
   Answers will vary, but students' composition methods should equal 145.
5. Show students the place value chart on the board. Ask students to share ways that the chart might help them decompose numbers. (Students may say that a place value chart helps them more easily see how to write numbers in expanded notation.)
6. Write or display the following numbers on the board:
   $60{,}000 + 7{,}000 + 800 + 90 + 1$
   $(6 \times 10{,}000) + (7 \times 1{,}000) + (8 \times 100) + (9 \times 10) + (1 \times 1)$
7. Ask students to look at the numbers on the board and talk to their Shoulder Partner about whether they represent the same numeral or different numerals.
   They represent the same numeral.
8. Tell students that this strategy for decomposing numbers combines expanded form and multiplying by multiples of 10, which they learned about in Lesson 4. They can think of it as decomposed form.

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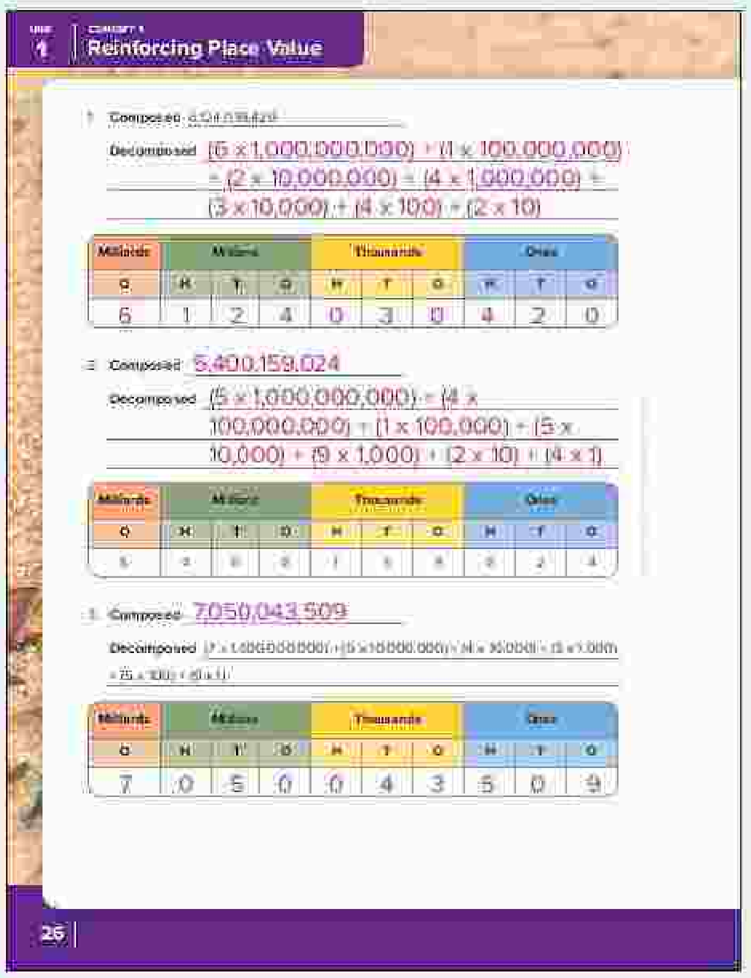


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Student Page 26



Unit 1 | Reinforcing Place Value

1. Composed: [illegible]

Decomposed: (6 × 1,000,000,000) + (1 × 100,000,000) + (2 × 10,000,000) + (4 × 1,000,000) + (3 × 10,000) + (4 × 100) + (2 × 10)

Milliards	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O
6	1	2	4	0	3	0	4	2	0

2. Composed: 5,400,159,024

Decomposed: (5 × 1,000,000,000) + (4 × 100,000,000) + (1 × 100,000) + (5 × 10,000) + (9 × 1,000) + (2 × 10) + (4 × 1)

Milliards	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3. Composed: 7,050,043,509

Decomposed:

Milliards	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O
7	0	5	0	0	4	3	5	0	9

26

Composing and Decomposing Numbers

(20 min)

9. Ask students to work independently to complete the problems in BUILD Composing and Decomposing Numbers. If the whole class is struggling, work with the whole group to solve the problems, modeling your thinking by doing a Think Aloud. Guide students' thinking by asking questions that help them consider next steps. If some students are able to work independently but others are struggling, work with a small group of students to support their learning.

   1. Decomposed: (6 × 1,000,000,000) + (1 × 100,000,000) + (2 × 10,000,000) + (4 × 1,000,000) + (3 × 10,0000) + (4 × 100) + (2 × 100)

   2. Decomposed: (5 × 1,000,000,000) + (4 × 100,000,000) + (1 × 100,000) + (5 × 10,000) + (9 × 1,000) + (2 × 10) + (4 × 1)

   3. Composed: 7,050,043,509

   4. Answers will vary, but make sure students have accurately composed and decomposed their selected numbers.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 6 CONNECT Writing About Math and ask them to respond to the prompt.

TEACHER NOTE: Consider collecting and reviewing students' Writing About Math entries. The information students provide will help you determine who needs additional support and may help you identify appropriate instructional strategies.

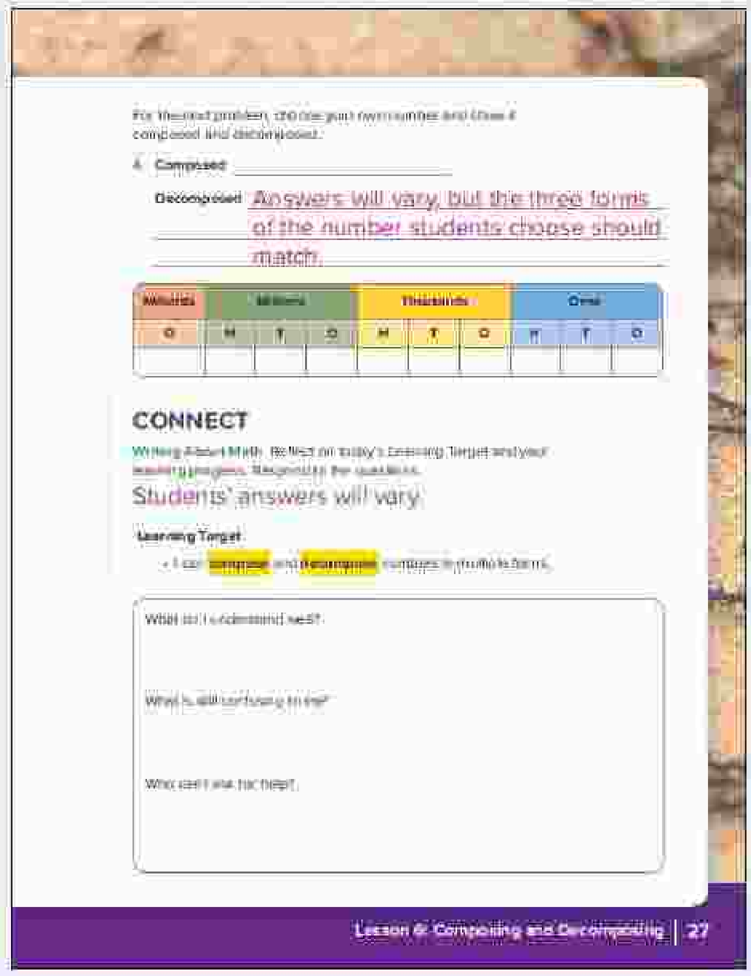
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to explain the strategies they used to complete the BUILD problems. Encourage students to help each other correct errors and discuss strategies that worked for them.

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Student Page 27


For the next problem, choose your own number and show it composed and decomposed.

4. Composed ________

Decomposed Answers will vary, but the three forms of the number students choose should match.

Billions	Millions			Thousands			Ones		
O	H	T	O	H	T	O	H	T	O

CONNECT

Writing About Math: Reflect on today's Learning Target and your learning progress. Respond to the questions.

Students' answers will vary.

Learning Target

- I can compose and decompose numbers in multiple forms.

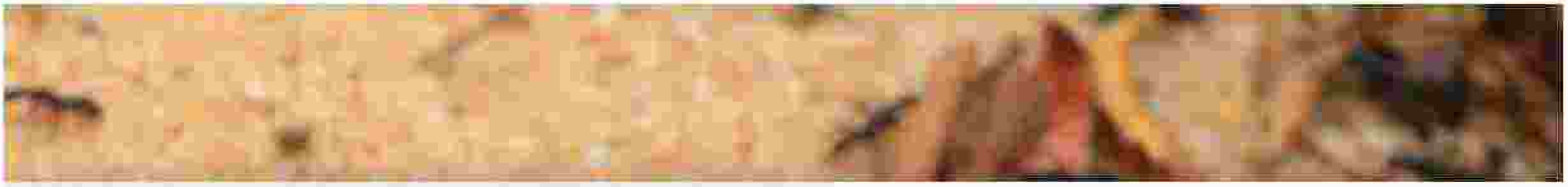
What do I understand well?

What is still confusing to me?

Who can I ask for help?

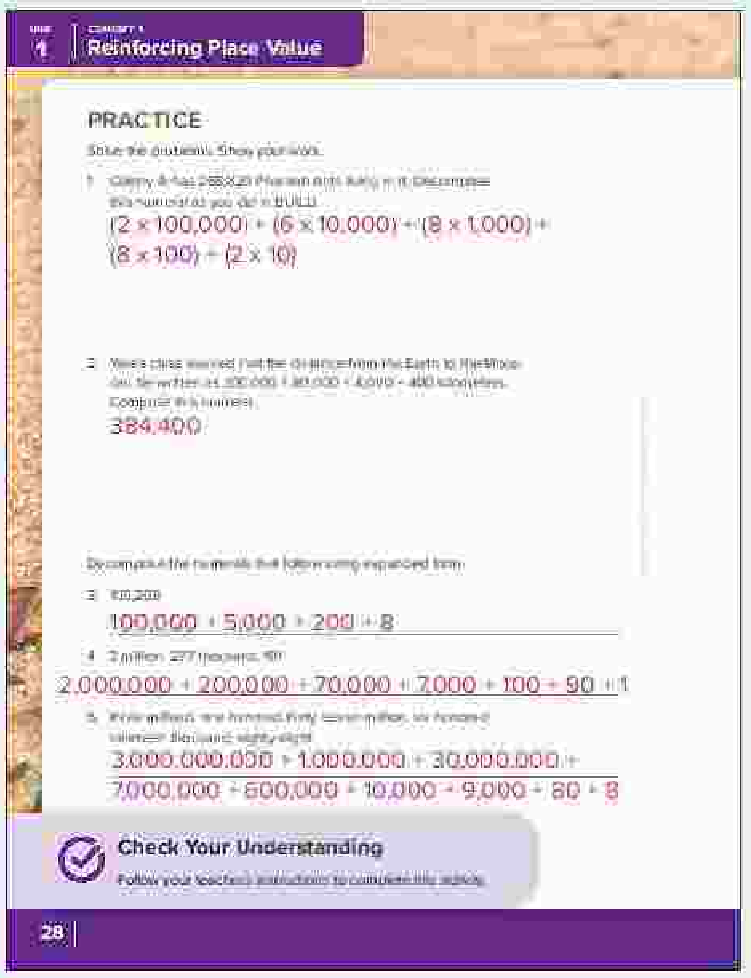
Lesson 6: Composing and Decomposing | 27

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Student Page 28



Reinforcing Place Value

PRACTICE

1. (2 × 100,000) + (6 × 10,000) + (8 × 1,000) + (8 × 100) + (2 × 10)

2. 384,400

3. 100,000 + 5,000 + 200 + 8

4. 2,000,000 + 200,000 + 70,000 + 7,000 + 100 + 90 + 1

5. 3,000,000,000 + 1,000,000 + 30,000,000 + 7,000,000 + 600,000 + 10,000 + 9,000 + 80 + 8

Check Your Understanding

28

PRACTICE

Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions around composing and decomposing numbers.

Check Your Understanding

Decompose the numeral below using expanded form.

1. 67 million, 38 thousand, 12
   60,000,000 + 7,000,000 + 30,000 + 8,000 + 10 + 2

Decompose the numerals below as you did in BUILD:

2. nine million, four hundred forty thousand, two hundred twenty
   (9 × 1,000,000) + (4 × 100,000) + (4 × 10,000) + (2 × 100) + (2 × 10)
3. six milliard, nine hundred million, ten thousand four
   (6 × 1,000,000,000) + (9 × 100,000,000) + (1 × 10,000) + (4 × 1)
4. eight million, seventy thousand, two hundred
   (8 × 1,000,000) + (7 × 10,000) + (2 × 100)
5. twenty-seven hundred
   (2 × 1,000) + (7 × 100)

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1: Reinforcing Place Value. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Concept Essential Questions

- How can I use mathematical vocabulary to build understanding of place value?
- How does the value of a digit change as it moves in a whole number?
- How does the value of a digit change as it moves one place to the left within a whole number?
- How can numbers be broken apart?
- How does breaking numbers apart help us understand them?

Learning Objectives

In this lesson

- Students will work to correct misconceptions and errors related to place value.

Grade-Level Standards

4.A.1 Apply and extend understanding of the place value system to multi-digit whole numbers.

4.A.1.a Demonstrate understanding that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

Materials List

- Materials may vary

DIGITAL



Concept Check-In and Remediation

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4.A.1.b Explain place value using numbers to 1,000,000,000, including the relative sizes of numbers in each place.

4.C.1 Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.C.1.a Interpret a multiplication equation as a comparison (for example, 42 = 7 × 6 as a statement that 42 is 7 times as many as 6).

Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that the position of a digit in a numeral determines its value.
- Students may struggle to read large numbers correctly utilizing Ones, Thousands, Millions, and Milliards.
- Students may be able to identify the place values and periods but may not recognize the pattern or relationship between each place.
- Students may be confused about how to represent a place value with a 0 digit in expanded form.
- Students may struggle to say large numbers and need to be reminded to group the numbers into periods as they read them aloud.
- Students may not be sure how to represent a zero in a place when the number is decomposed.
- Students may not connect digits in their place values, expanded notation, and decomposing numbers.

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Remediation: Correcting Misconceptions

If...	**Then...**
Students are unable to explain the relationship between a digit's place and its value or are unable to explain the relationships between neighboring place values.	Review Lessons 3 and 4. Consider using place value manipulatives to help students understand the relationships between Ones, Tens, and Hundreds. Use a place value chart to help students build numbers and identify the value of each digit within the number.
If...	**Then...**
Students do not understand how to accurately represent zero in various forms, including decomposing numbers.	Review Lessons 5 and 6. Consider using place value manipulatives to help students build a number, then write it in word and expanded form using their manipulatives as a guide.
If...	**Then...**
Students do not understand how to represent numbers in expanded form.	Review Numeral Form Exploration from Lesson 5. Consider using a combination of place value manipulatives and a place value chart to help students connect the place value of each digit within a numeral to its standard form.

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CONCEPT

2

Using Place Value

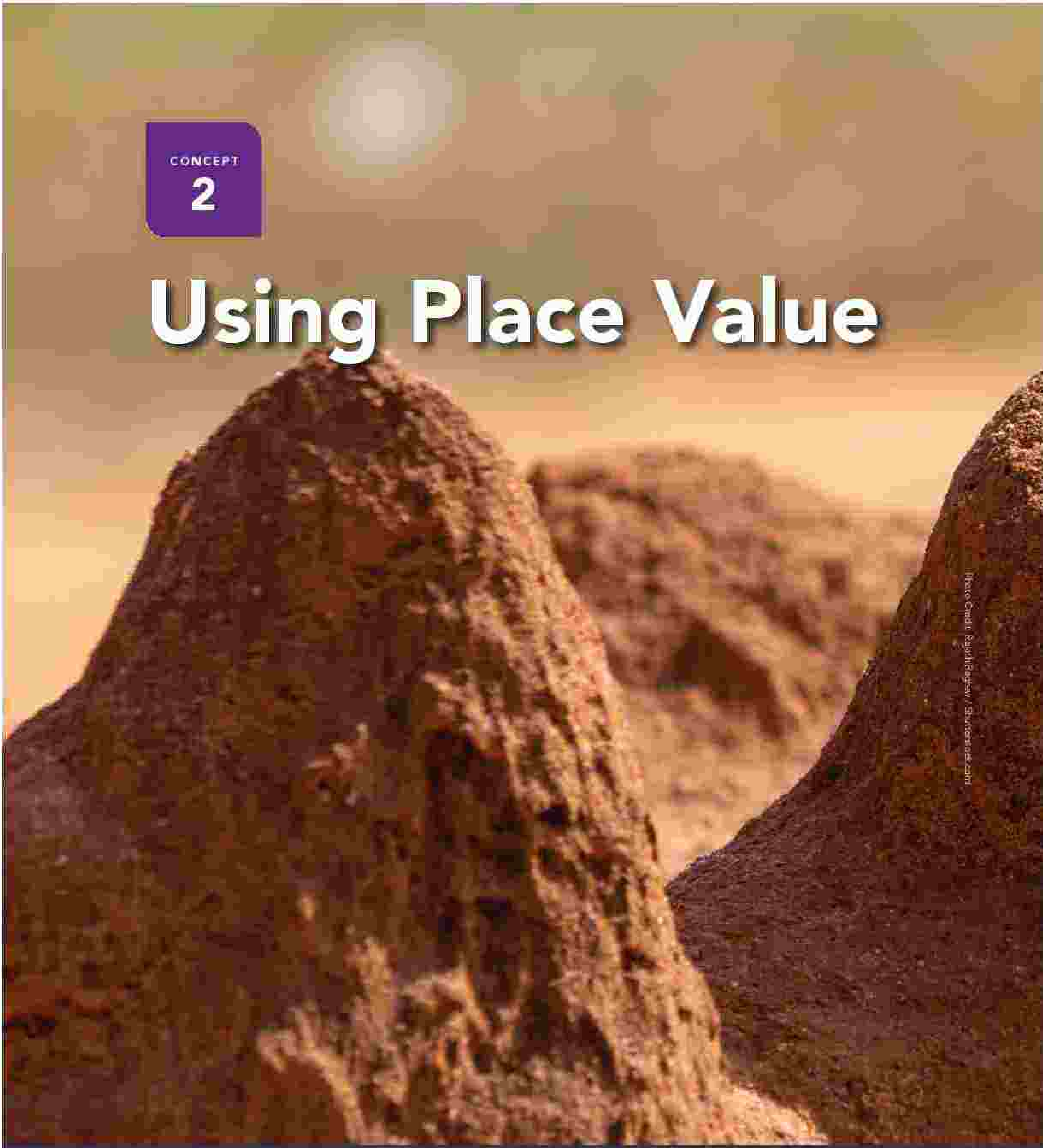


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Concept Overview

In Concept 2: Using Place Value, students apply what they have learned about place value to compare and order very large numbers. Students build understanding of the importance of place value in reading, writing, and understanding numerals to the One Milliard place and in estimating. Students review the purpose of estimation and practice two strategies—front-end estimation and rounding using place value—and determine which strategy provides the most accurate estimates. These place value concepts help students master more challenging concepts in Primary 4, including multiplication, division, fractions, and decimals.

Concept Standards

4.A.1.c Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.d Use place value understanding to round multi-digit whole numbers up to the milliards (billions) place.

4.A.1.e Order a set of numbers up to the Milliard place.

4.A.1.f Compare two multi-digit numbers using the symbols <, >, = to express the relationship.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives
7 Review Comparing Really Big Numbers	• Digit Cards 1–9 (1 set per student) (From Lesson 2) • Comparison Symbols (Found at the end of this volume)	Compare Efficient Equal to Error analysis Greater than Less than	• Students will use place value to compare large numerals. • Students will use symbols to express numerical comparisons.
8 Comparing Numbers in Multiple Forms	• Chart paper • Markers • Digit Cards 0–9 (1 set per student) (from Lesson 2)	Decomposed form Efficient Expanded form Standard form Word form	• Students will compare numbers in multiple forms. • Students will describe strategies for comparing numbers in multiple forms.

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students sometimes compare the number of digits in a numeral rather than the value of the largest digit. • Students sometimes forget to consider how many digits are in a numeral when they compare.	Comparing Ant Hills, Using Greater Than and Less Than to Compare, Writing About Math, Practice, Check Your Understanding
	• Students may struggle with comparing numbers in word form or expanded notation. • Students may struggle with finding a system that helps them compare numbers in different forms.	Strategies for Comparison, Number Battle, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
9 Descending and Ascending Numbers	• Set of 5 large notecards or sheets of paper, each with 1 number written on it: – 78,090 – 79,010 – 78,091 – 79,100 – 78,999 • Set of 4 large notecards or sheets of paper, each with 1 number written on it: – three milliard, ten million, one thousand, thirty-four – three milliard, one million, three hundred twenty-three thousand, three hundred ninety-one – three milliard, nine hundred ninety thousand, nine hundred ninety-two – three milliard, one hundred ten million, ninety-nine thousand, four hundred ninety-three	Ascending Compare Decomposed form Descending Expanded form Order Standard form Word form	• Students will order numbers in multiple forms. • Students will describe strategies for ordering numbers in multiple forms.	
10 Predicting the Unpredictable	• No additional materials needed	Estimation Front-end estimation Reasonable	• Students will explain front-end estimation. • Students will use front-end estimation to approximate large numbers.	
11 Rounding Rules	• Two sets of Large Digit Cards 0–9 (For the teacher) • Rounding Rule on chart paper: *Circle the digit, look next door.* *5 or higher? Add one more.* *4 or less? Let it rest.*	Accurate Estimation Nearest Reasonable Rounding	• Students will apply multiple strategies to round numbers. • Students will discuss whether rounding or front-end estimation provide a more accurate estimate.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not understand the place value relationships between the standard, word, and expanded forms of a number. • Students may not understand that numbers can be ordered in multiple forms (standard, word, or expanded form). • Students may struggle to compare and order numbers with similar digits and need to be reminded to start on the left and compare each digit while moving to the right of a number.	Ascending and Descending Numbers, Writing About Math, Practice, Check Your Understanding
	• Students may struggle with knowing when to estimate and when an exact number is needed to solve a problem. • Students may confuse front-end estimation with other rounding strategies. • Students may not understand the value of determining the reasonableness of answers.	Exact or Not?, Front-End Estimation, Writing About Math, Vocabulary Builder, Practice, Check Your Understanding
	• Students may misapply the rule for rounding down and actually lower the value of the digit in the designated place instead of keeping it the same or increasing it by one. • Students may misapply the rule for rounding up and change the digit in the designated place, while not changing digits in smaller places to zeroes. • Students often only use front-end estimation for determining the reasonableness of answers. Rounding provides more accurate estimates.	Rounding Using the Midpoint Strategy, Rounding Rule, Which Strategy is Best?, Place Value and Rounding Practice, Check Your Understanding

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials will vary	• Review vocabulary terms as needed.	• Students will work to correct misconceptions and errors related to comparing, ordering, and rounding numbers.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students do not often consider how many digits are in a numeral when they compare. • Students may struggle with comparing numbers in word form or expanded notation. • Students may struggle with finding a system that helps them compare numbers in different forms. • Students may not understand the place value relationships between the standard, word, and expanded forms of a number. • Students may struggle to compare and order numbers with similar digits and need to be reminded to start on the left and compare each digit while moving to the right of a number. • Students may struggle with knowing when to estimate and when an exact number is needed to solve a problem. • Students may misapply the rule for rounding down and actually lower the value of the digit in the designated place instead of keeping it the same or increasing it by one. • Students may misapply the rule for rounding up and change the digit in the designated place, while not changing digits in smaller places to zeroes.	Concept Check-In

LESSON 7
Review Comparing Really Big Numbers

Lesson Overview

In this lesson, students use their growing understanding of place value to build, read, and compare very large numbers. They review and use the mathematical symbols we use to compare numbers, using place value to help them make accurate and efficient comparisons.

Lesson Essential Question

- How can we efficiently compare very large numbers?

Learning Objectives

In this lesson

- Students will use place value to compare large numerals.
- Students will use symbols to express numerical comparisons.

Grade-Level Standards

4.A.1.c Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.d Use place value understanding to round multi-digit whole numbers up to the milliards (billions) place.

4.A.1.f Compare two multi-digit numbers using the symbols <, >, = to express the relationship.

Vocabulary Check-In

compare, efficient, equal to, error analysis, greater than, less than

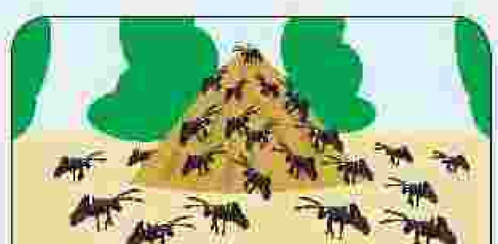
Materials List

- Digit Cards 1–9 (1 set per student) (from Lesson 2)
- Comparison Symbols

Preparation

Photocopy the Blackline Master of Comparison Symbols at the end of this volume.

DIGITAL



Lesson 7
Review Comparing Really Big Numbers

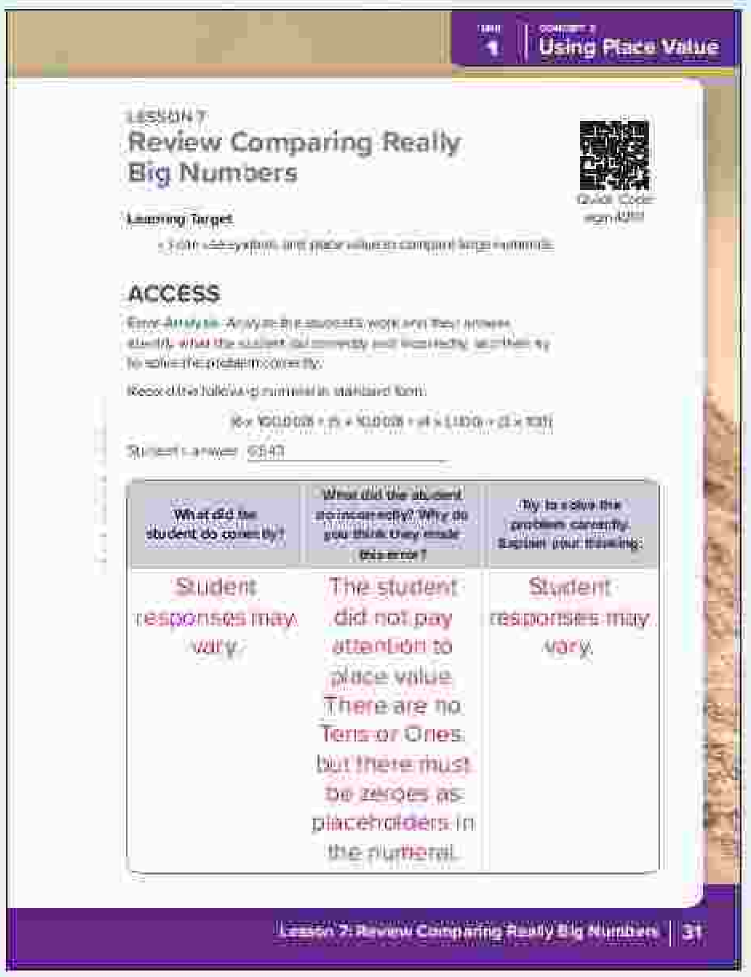
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What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.
Student responses may vary.	The student did not pay attention to place value. There are no Tens or Ones, but there must be zeroes as placeholders in the numeral.	Student responses may vary.

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes compare the number of digits in a numeral rather than the value of the largest digit.
- Students sometimes forget to consider how many digits are in a numeral when they compare.

Error Analysis

1. Ask students to turn to Lesson 7 ACCESS Error Analysis.
2. Explain to students that this problem is an error analysis problem. Remind students that they solved error analysis problems in Primary 3. When analyzing errors, they must figure out what the student in the problem did right, what they did wrong, and correct the mistakes. This will help them analyze and correct errors in their own work, which helps them become better thinkers and mathematicians.
3. Ask students to complete the error analysis problem. After about 7 minutes (or sooner, if students are done), ask volunteers to share what they noticed and how they corrected the student's error.
   The student in the problem did not pay attention to place value. There are no Tens or Ones, but there must be zeroes as placeholders in the numeral.

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BUILD (40 min)

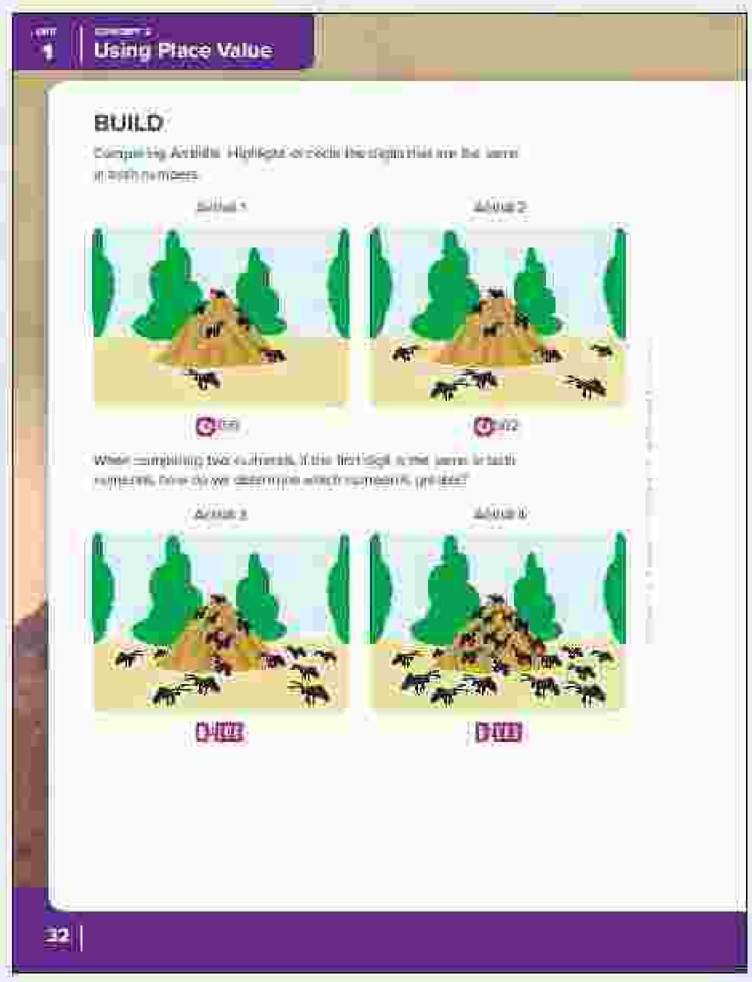
Comparing Anthills (15 min)

1. Direct students to Lesson 7 BUILD Comparing Anthills. Use Calling Sticks to select students to read each number under Anthills 1 and 2 aloud.
2. Ask students to highlight or circle the digits that are the same in both numbers (4).
3. Ask students to identify the digit's place value (One Thousands place) and how much that digit is worth in each numeral (4,000).
4. Ask students to talk to a partner to answer the following question: When comparing two numerals, if the first digit is the same in both numerals, how do we determine which numeral is greater?
5. Ask volunteers to share their ideas. Ensure that students understand that they must first make sure the two numbers have the same number of digits and THEN compare the next value of the digit in the next place to the right.
6. Repeat steps 1–5 with Anthills 3 and 4.
7. Ask students to discuss how they can use place value helps to compare really big numbers.

TEACHER NOTE: Help students connect this activity to their learning in Lesson 6, reinforcing this with writing and modeling on the blackboard as needed. For example, with Ant Hills 3 and 4, students should note that each numeral has the same digit in the Ten Thousands place, but Ant Hill 3 has 4 × 1,000 in the Thousands place and Ant Hill 4 has 5 × 1,000 in the Thousands place.

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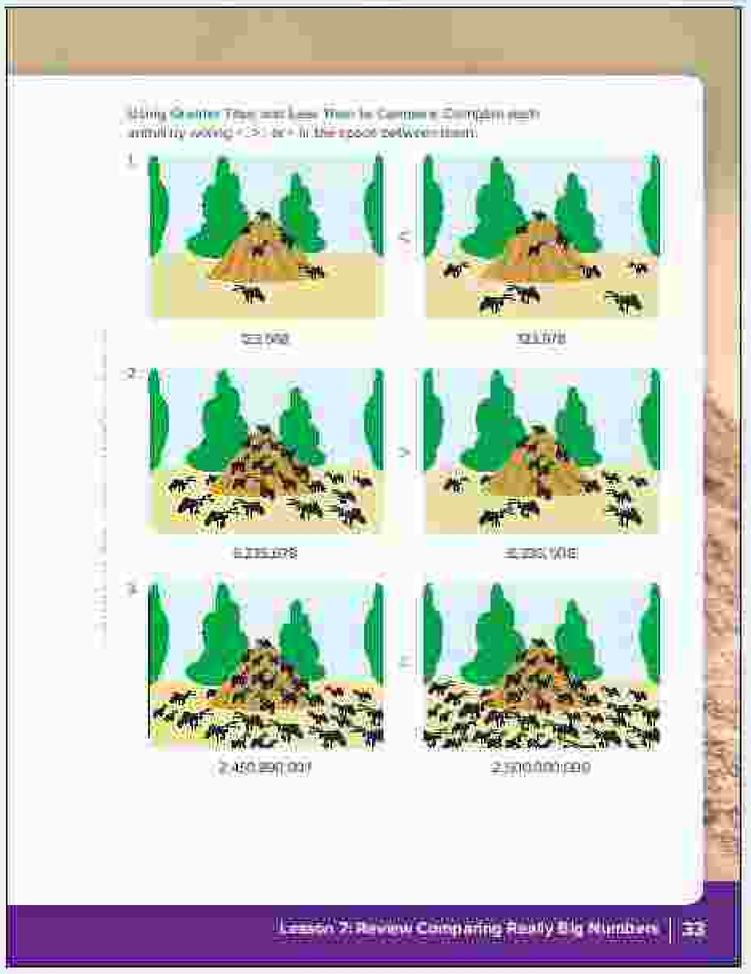
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Using Greater Than and Less Than to Compare, Write an Explanation (25 min)

1. Write the two numerals from Anthills 1 and 2 from Comparing Anthills on the board. Leave enough space between the numbers to add a comparison sign. Ask students to read the numerals aloud again.
2. Display the cards <, >, and = and ask students to explain what each symbol means and how they use them to compare numbers.
3. Use Calling Sticks to select a student to come to the front and tape the appropriate symbol between the two numbers. Ask the student to explain their thinking. Explain to students that the strategies they use should be efficient—in other words, they help them solve problems quickly and accurately. For example, they could compare two numbers using Base Ten blocks and get the correct answer, but that strategy would take a long time and would not be efficient.

   TEACHER NOTE: If students struggle with this activity, write the numerals in a place value chart and ask guiding questions to help them compare the two numerals.

4. Repeat the procedure again, first using the numerals 95,000 and 950,000 and then using the numerals 25,411,239 and 24,411,293. Be sure to have students chorally read the numerals aloud before comparing them. As students work, reinforce the importance of using what they know about place value to compare the large numerals.
5. Direct students to Lesson 7 BUILD Using Greater Than and Less Than to Compare and work in pairs or small groups to complete the learning activities Using Greater Than and Less Than to Compare and Write an Explanation. When there are about 5 minutes left in BUILD, go over the answer together.

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CONNECT (5 min)

Writing About Math

Direct students to Lesson 7 CONNECT Writing About Math and ask them to respond to the prompt. Students may use different strategies, but all students should mention using place value as a strategy.

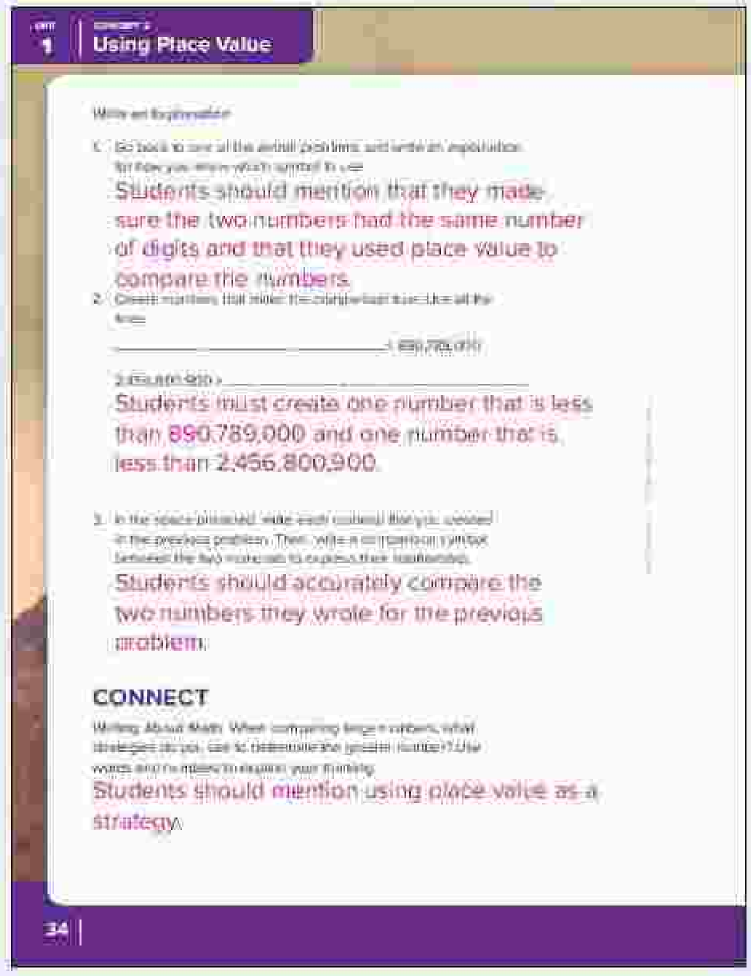
WRAP-UP (5 min)

Let's Chat About Our Learning

1. Ask students to share their ideas from CONNECT. If necessary, guide students to share how they can use place value—and the value of the digits within a number—to compare large numbers.
2. Ask students to think about the following questions: Why is it important for us to be able to compare numbers? When might we need to compare numbers outside of school?
3. Ask students to Turn and Talk to share their ideas with a partner.
4. Use Calling Sticks to select 2–3 students to share their thinking. Encourage students to use real world connections to explain the importance of being able to compare numbers.

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UNIT 1 | Using Place Value

Students should mention that they made sure the two numbers had the same number of digits and that they used place value to compare the numbers.

Students must create one number that is less than 890,789,000 and one number that is less than 2,456,800,900.

Students should accurately compare the two numbers they wrote for the previous problem.

CONNECT

Students should mention using place value as a strategy.

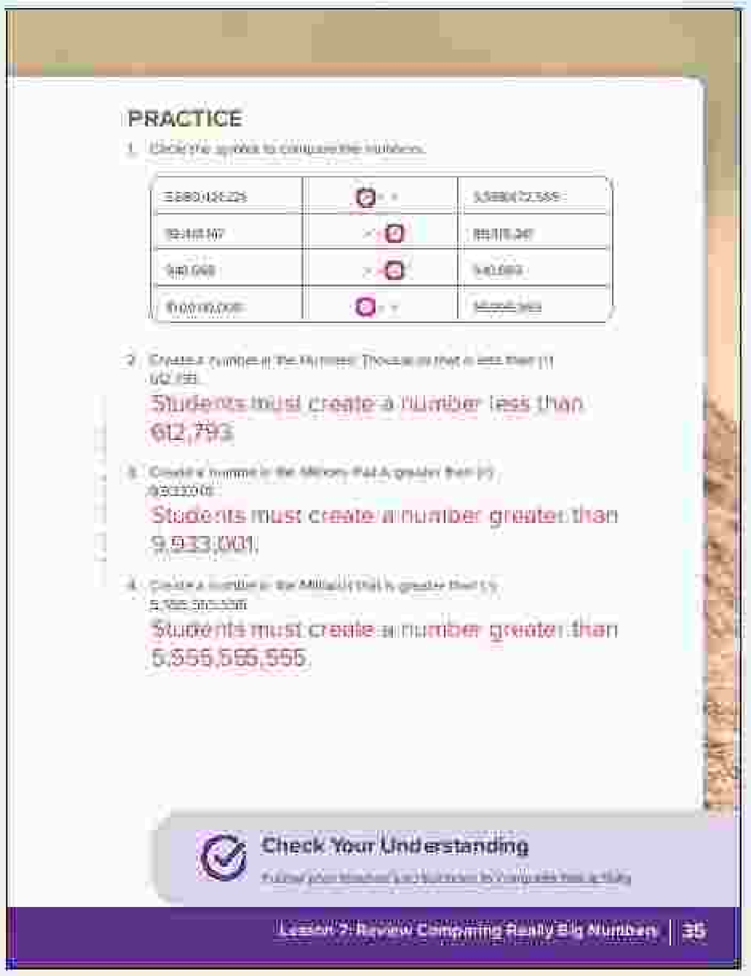
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PRACTICE

Students must create a number less than 612,793.

Students must create a number greater than 9,933,001.

Students must create a number greater than 5,555,555,555.

Check Your Understanding

Lesson 7: Review Comparing Really Big Numbers | 35

PRACTICE

Direct students to Lesson 7 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Circle the symbol to compare the numbers.

1,231,425,234	<	1,321,454,435
67,353,622	<	67,353,630
40,243,021	>	40,209,314
999,999,999	<	1,000,000,000

2. Create a number in the Hundred Thousands that is less than (<) 893,824.
   Students must create a number less than 893,824.

3. Create a number in the Ten Millions that is greater than (>) 34,450,600,125.
   Students must create a number greater than 34,450,600,125.

4. Create a number in the Milliards that is greater than (>) 3,456,789,000.
   Students must create a number greater than 3,456,789,000.

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LESSON 8
Comparing Numbers in Multiple Forms

Lesson Overview

In this lesson, students combine their understanding of writing numbers in different forms with the previous lesson of comparing numbers. They compare numbers in a combination of forms (standard, written, expanded, decomposed). They create their own strategies to help them compare.

Lesson Essential Question

- How can we efficiently compare very large numbers?

Learning Objectives

In this lesson

- Students will compare numbers in multiple forms.
- Students will describe strategies for comparing numbers in multiple forms.

Grade-Level Standards

4.A.1.c Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.d Use place value understanding to round multi-digit whole numbers up to the milliards (billions) place.

4.A.1.f Compare two multi-digit numbers using the symbols <, >, = to express the relationship.

Vocabulary Check-In

decomposed form, efficient, expanded form, standard form, word form

Materials List

- Chart paper
- Markers
- Digit Cards 0–9 (1 set per student) (from Lesson 2)

DIGITAL



Lesson 8
Comparing Numbers in Multiple Forms

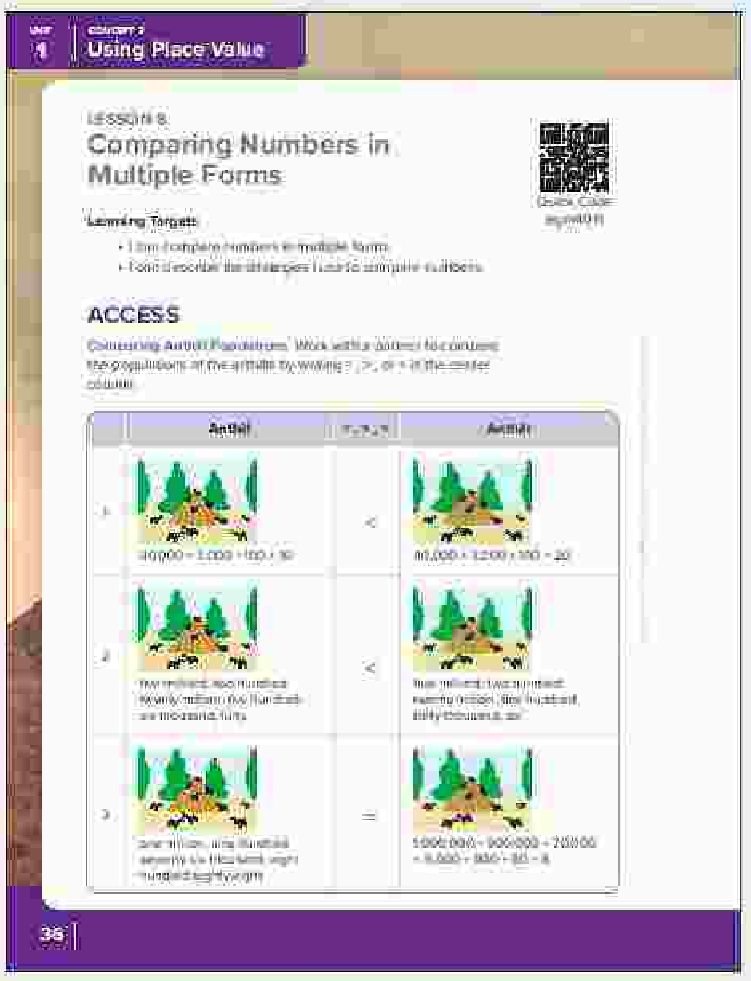
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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle with comparing numbers in word form or expanded notation.
- Students may struggle with finding a system that helps them compare numbers in different forms.

Comparing Anthill Populations

1. Remind students that in their last math lesson, they worked to compare numbers in standard form. They tried to find and use strategies that helped them efficiently compare numbers—strategies that enabled them to work quickly and find the correct answer. Today they will take on a greater challenge by comparing numbers in multiple forms.
2. Ask students to turn to Lesson 8 ACCESS Comparing Anthill Populations. Explain that these numbers are written in word and expanded forms. Ask students to work with a Shoulder Partner to compare the numbers using greater than, less than, or equal to symbols.
3. After a few minutes, ask student volunteers to share the strategies they used, particularly for the last problem where they compared two different forms. (Some students may have converted them to standard form, while others may have used the place value indicated in the word or expanded form.)

   TEACHER NOTE This task can serve as a formative assessment and can help guide the support you offer to students in the remainder of this lesson. It may be very difficult for some students to compare numbers in forms other than standard. Consider working with those students in small groups using a place value chart to "decode" and compare numbers.

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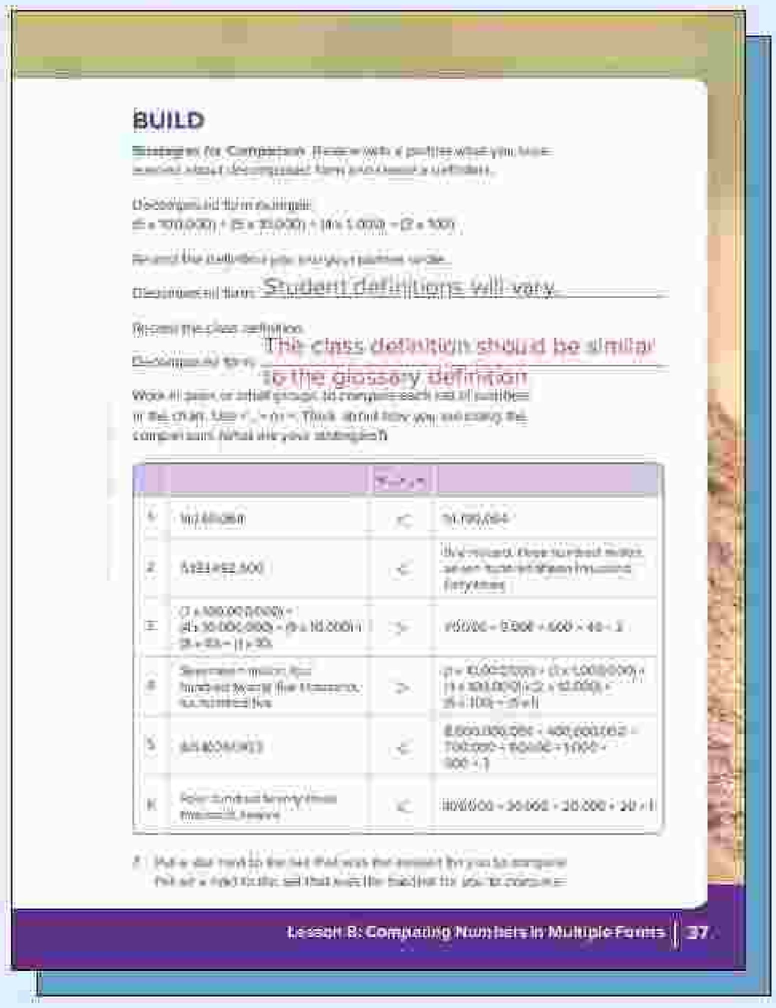
BUILD (40 min)

Strategies for Comparison (25 min)

1. In Lesson 5, students defined three forms of numbers (standard, word, and expanded). In Lesson 6, students decomposed numbers and wrote them in decomposed form. Direct students to Lesson 8 BUILD Strategies for Comparison and ask them to review decomposed form.
2. Ask students to work with their Shoulder Partner to create and record a definition for decomposed form.
3. Ask partners to share their definitions with the class. Use students' definitions to create a class definition. Direct students to record the class definition in their Student Materials.
   Students' definitions may vary, but the class definition should be similar to the glossary definition.
4. As a class, create an anchor chart called "Strategies for Comparing Really Big Numbers." First, ask students to talk to their Shoulder Partner about the strategies they used in the previous lesson when comparing numbers in standard form. Then, have students share their strategies and record them on the class anchor chart. Model if needed. (Possible strategies students may name include: counting the number of digits first to see which has more; comparing the first digit to see which is bigger; and comparing the second digit if the first digit is the same in both numbers.)
5. Tell students that today they will compare numbers in multiple forms and will continue adding to the class anchor chart.
6. Have students return to BUILD and work in pairs or small groups to complete Problems 1–7. After about 5 minutes, ask students to share their answers and explain their strategies.
7. Ask students if they have any new strategies to add to the anchor chart, particularly for comparing numbers in multiple forms. (Possible strategies students may name: change one number so that they are in the same form; change both numbers so they are in standard form; and look at the highest place value.)

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Student Pages 37–38



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Number Battle (15 min)

1. Tell students that today they will play Number Battle with two other students to practice building, reading, and comparing numbers. Ask two volunteers to come to the front of the room to play one round with you to model the process.

   Number Battle Directions

   - The game requires 3 players. 2 players are "builders" and 1 player is the "reader."
   - Each player needs a set of digit cards 0–9.

     1. Players will combine the 3 decks (30 cards), shuffle the cards, and place them face down in the middle.
     2. Each builder draws 11 cards.
     3. Each builder uses 10 of their cards to create the greatest number possible and discards the 11th card.
     4. The reader will read each builder's number aloud.
     5. The builders write their number and their partner's number in the table in their Student Materials. Be sure to pay attention to how the numbers should be recorded for each round.
     6. The builders compare their numbers and record the appropriate sign (< or >).
     7. The builders discuss: Which place value did you use to determine which number was greater?
     8. Rotate roles and play again.

2. Create small groups of 3. Have groups play for the remainder of BUILD. Remind students to rotate roles after each round.

3. Tell students that when they have finished comparing four rounds of the game, they should circle their greatest number and draw a box around their smallest number.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 8 CONNECT Writing About Math and ask them to respond to the prompt.

TEACHER NOTE: Consider collecting and reviewing students' Writing About Math entries to determine how well they understand comparing large numbers in multiple forms. This information may help you set up learning groups for future lessons and Concept Check-In and Review.

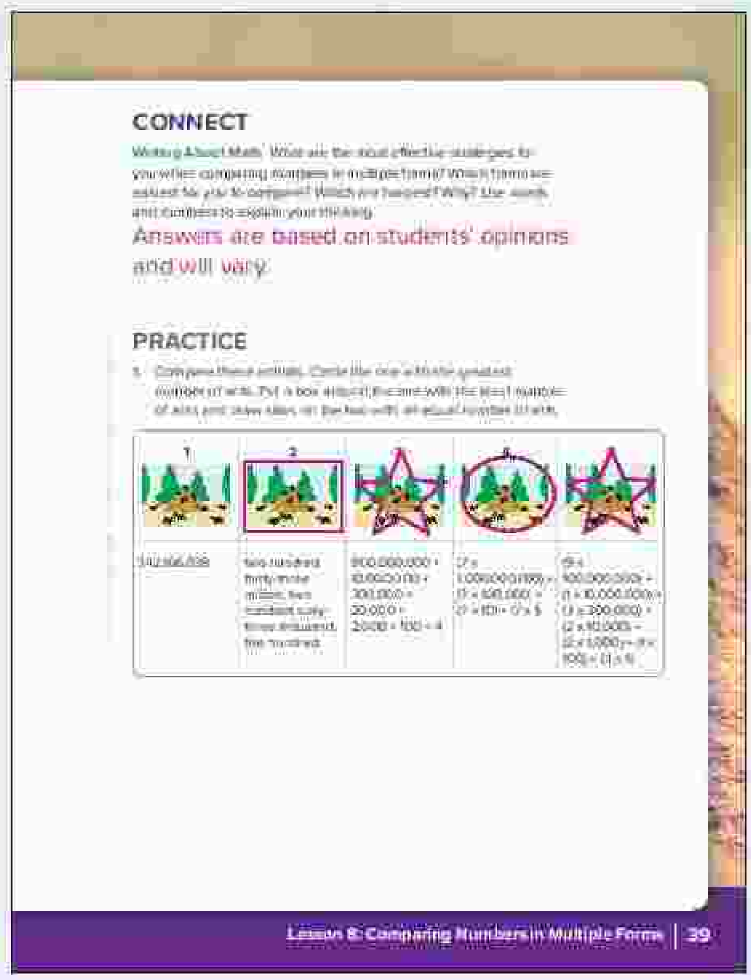
WRAP-UP (3 min)

Numbers in the Real World

Ask students to discuss when they might need to compare numbers in different forms in the real world. What strategies have they learned to help them do that?

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CONNECT

Writing About Math: What are the most effective strategies for you when comparing numbers in multiple forms? Which forms are easiest for you to compare? Which are hardest? Why? Use words and numbers to explain your thinking.

Answers are based on students' opinions and will vary.

PRACTICE

1. Compare these animals. Circle the one with the greatest number of ants. Put a box around the one with the least number of ants and draw stars on the two with an equal number of ants.

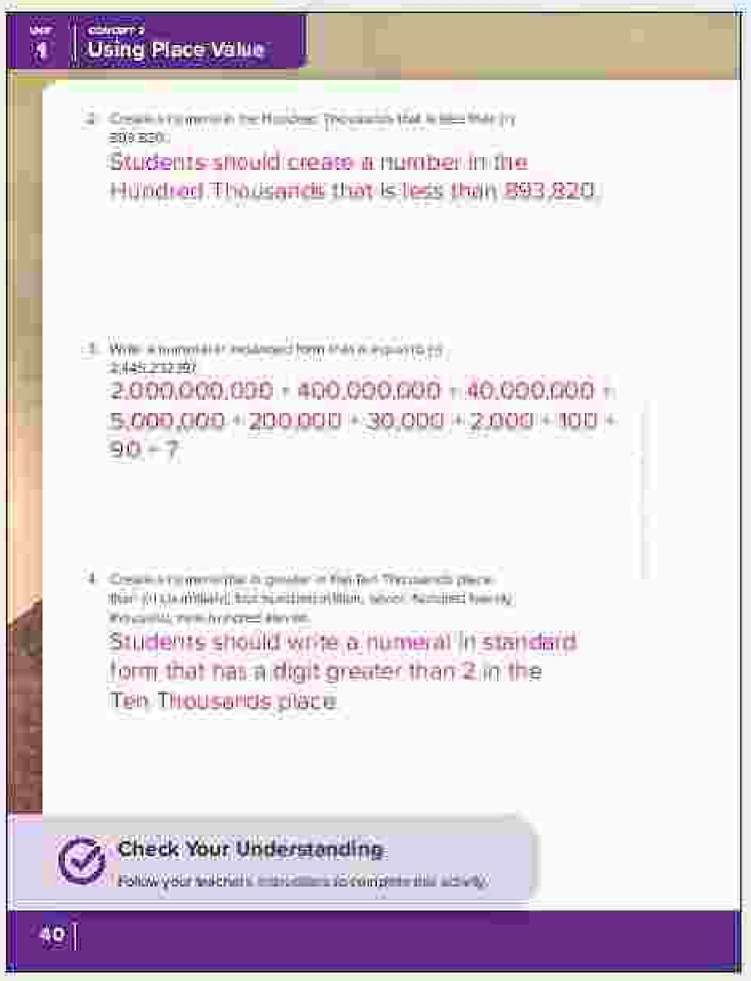
Lesson 8: Comparing Numbers in Multiple Forms | 39

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UNIT 1 | CONCEPT 2 Using Place Value

2\. Students should create a number in the Hundred Thousands that is less than 893,820.

3\. 2,000,000,000 + 400,000,000 + 40,000,000 + 5,000,000 + 200,000 + 30,000 + 2,000 + 100 + 90 + 7

4\. Students should write a numeral in standard form that has a digit greater than 2 in the Ten Thousands place.

Check Your Understanding

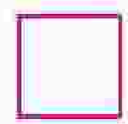
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PRACTICE

Direct students to Lesson 8 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Compare these anthills. Circle the one with the greatest number of ants. Put a box around the one with the least number of ants and draw stars on the two with an equal number of ants.

(1 × 1,000,000,000) + (3 × 100,000) + 10	456,320,126	400,000,000 + 50,000,000 + 6,000,000 + 300,000 + 20,000 + 100	four hundred fifty-six million, three hundred twenty thousand, one hundred twenty-six	(4 × 100,000,000) + (8 × 10,000,000) + (6 × 1,000,000) + (9 × 10,000) + (9 × 1,000) + (4 × 100) + (3 × 10) + 1
				

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LESSON 9
Descending and Ascending Numbers

Lesson Overview

In this lesson, students order very large numbers in multiple forms and apply the terms ascending and descending to their math vocabulary.

Lesson Essential Question

- How can understanding place value help us order very large numbers?

Learning Objectives

In this lesson

- Students will order numbers in multiple forms.
- Students will describe strategies for ordering numbers in multiple forms.

Grade-Level Standards

4.A.1.e Order a set of numbers up to the Milliard place.

4.A.1.f Compare two multi-digit numbers using the symbols < , > , = to express the relationship.

Vocabulary Check-In

ascending, compare, decomposed form, descending, expanded form, order, standard form, word form

Materials List

Set of 5 large notecards or sheets of paper, each with one number written on it:

- 78,090
- 79,010
- 78,091
- 79,100
- 78,999

Set of 4 large notecards or sheets of paper, each with one number written on it:

- three milliard, ten million, one thousand, thirty-four
- three milliard, one million, three hundred twenty-three thousand, three hundred ninety-one
- three milliard, nine hundred ninety thousand, nine hundred ninety-two
- three milliard, one hundred ten million, ninety-nine thousand, four hundred ninety-three

Preparation

Write the large numbers on the notecards or paper in advance.

DIGITAL



Lesson 9

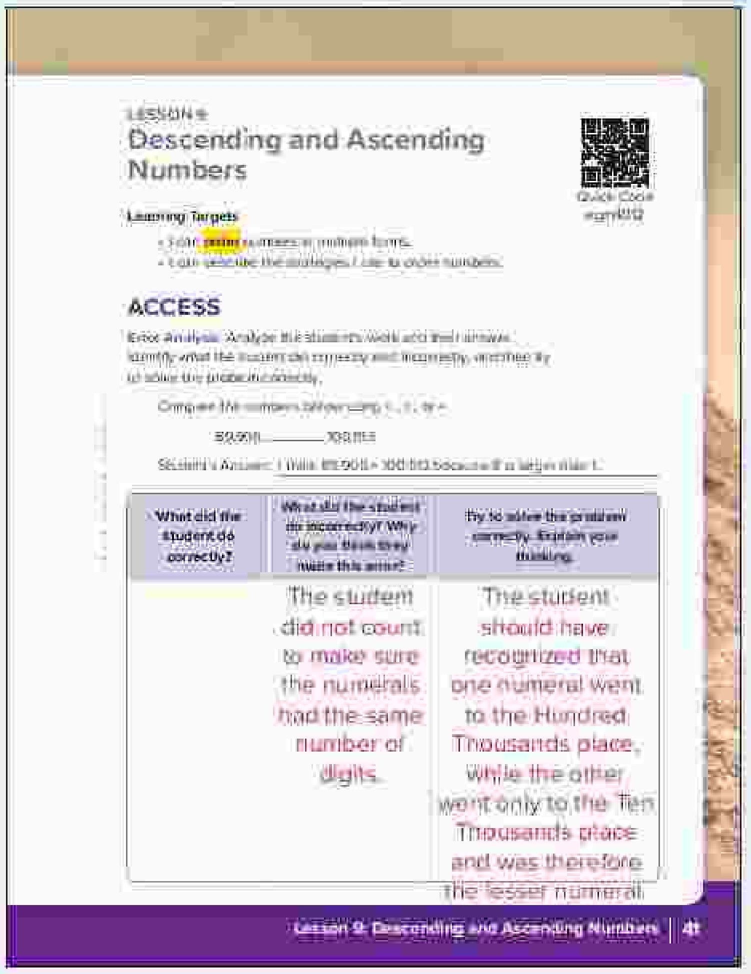
Descending and Ascending Numbers

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LESSON 9

Descending and Ascending Numbers

Quick Code

Learning Targets

- I can order numbers in multiple forms.
- [illegible]

ACCESS

Error Analysis: [illegible]

Compare the numbers below using <, >, or =.

[illegible]

Student's Answer: [illegible]

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.
	The student did not count to make sure the numerals had the same number of digits.	The student should have recognized that one numeral went to the Hundred Thousands place, while the other went only to the Ten Thousands place and was therefore the lesser numeral.

Lesson 9: Descending and Ascending Numbers | 41

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand the place value relationships between the standard, word, and expanded forms of a number.
- Students may not understand that numbers can be ordered in multiple forms (standard, word, or expanded form).
- Students may struggle to compare and order numbers with similar digits and need to be reminded to start on the left and compare each digit while moving to the right of a number.

Error Analysis

1. Ask students to turn to Lesson 9 ACCESS Error Analysis and solve the error analysis problem.
2. After 6–7 minutes, ask students to share their answers and thinking with the class.
3. Ask students to discuss how solving error analysis problems helps them become better mathematicians.

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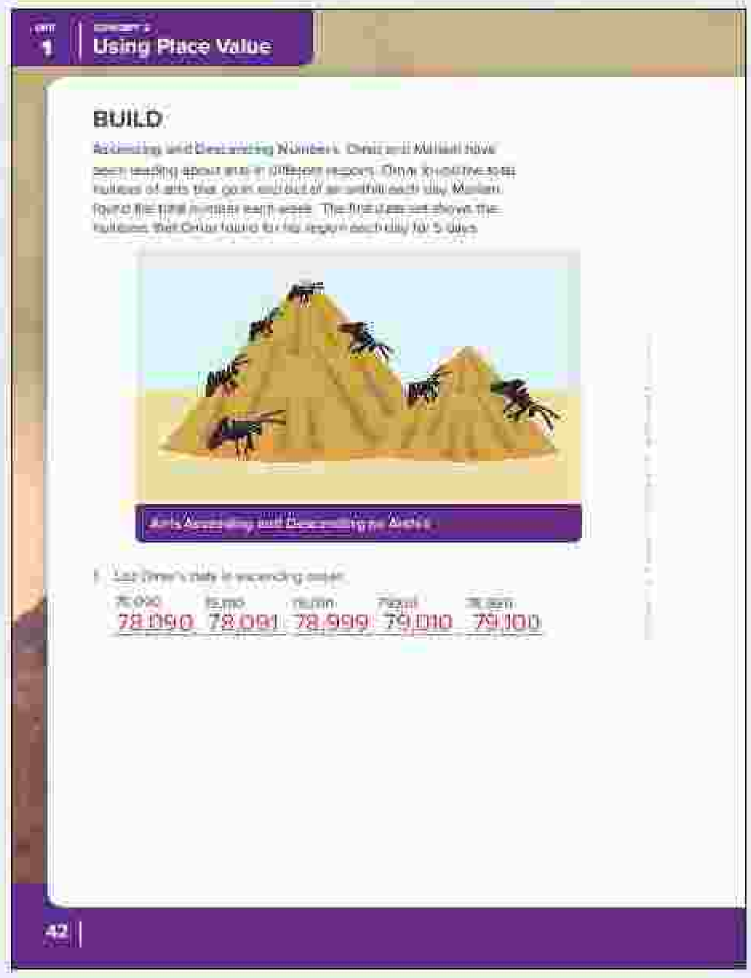
BUILD (40 min)

Ascending and Descending Numbers

1. Ask students to recall what they learned and practiced in the last lesson. Then, explain that today they take the next step in comparing as they order large numbers.
2. Tell students that we can sort numbers in either ascending or descending order. Ascending order is when numbers go up like an ant walking up an ant hill. They ascend up the hill. Connect to ordering numbers from least to greatest. Descending order is when numbers go down like an ant walking down an ant hill. They descend to the bottom. Connect to ordering numbers from greatest to least.
3. Direct students to Lesson 9 BUILD Ascending and Descending Numbers. Ask a student volunteer to read the scenario aloud.
4. Ask students to complete Problem 1, listing the numbers from Omar's data in ascending order.
5. After students are finished, use Calling Sticks to choose five volunteers come to the front of the room. Give each student a notecard with one of Omar's data points on it. Have students stand in a line facing the class holding the numbers in front of them.
6. Ask seated students to help arrange the numbers in ascending order (as they did in their Student Materials.) Ask students to share their reasoning and strategies for ordering the numbers as they did.
7. Have students return to their Student Materials and complete Problem 2, listing Mariam's data in descending order.
8. After a few minutes, use Calling Sticks to select 4 new students and repeat the ordering process, having seated students arrange the standing students and sharing their reasoning and strategies.

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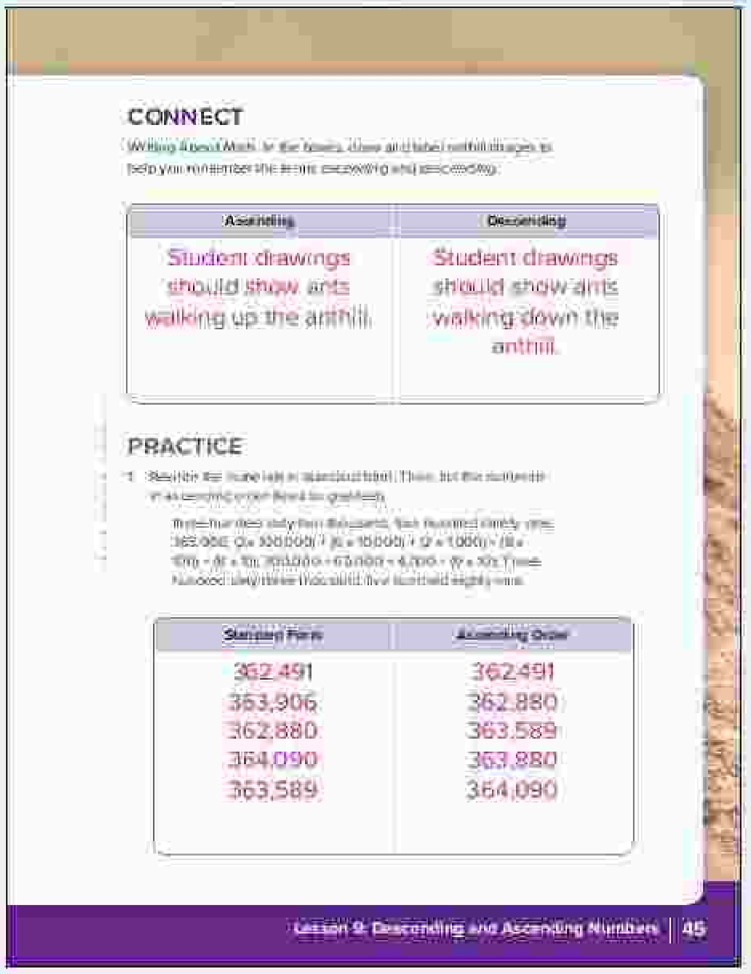
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CONNECT

Ascending	Descending
Student drawings should show ants walking up the anthill.	Student drawings should show ants walking down the anthill.

PRACTICE

Standard Form	Ascending Order
362,491	362,491
363,906	362,880
362,880	363,589
364,090	363,880
363,589	364,090

Lesson 9: Descending and Ascending Numbers | 45

9. Ask students to solve Problem 3 on their own. After a few minutes, go over the answers together. Ask students to share their reasoning and strategies for ordering numbers written in different forms.

10. If students are ready, have them complete BUILD Problems 3–5 on their own or with a partner.

CONNECT (7 min)

Writing About Math

1. Direct students to Lesson 9 CONNECT Writing About Math and ask them to respond to the prompt.

2. If time allows, ask students to volunteer to show their drawings or do a Gallery Walk.
   Students should draw an anthill with ants walking up the hill for ascending and an anthill with ants walking down the hill for descending.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to talk with their Shoulder Partner about the strategies they used for ordering very large numbers in multiple forms.

2. After about 30 seconds, have volunteers share their ideas. Add effective strategies to the class anchor chart started in Lesson 8. Remind students they can refer to the chart for assistance and support.

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PRACTICE

Direct students to Lesson 9 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Rewrite the numerals below in standard form. Then, list the numerals in descending order (greatest to least).

   six hundred forty-three thousand, nine hundred nineteen; 634,920; (6 × 100,000) + (4 × 10,000) + (3 × 1,000) + (9 × 100) + (2 × 10); 600,000 + 40,000 + 4,000 + 10; six hundred forty-four thousand, two hundred ninety-nine

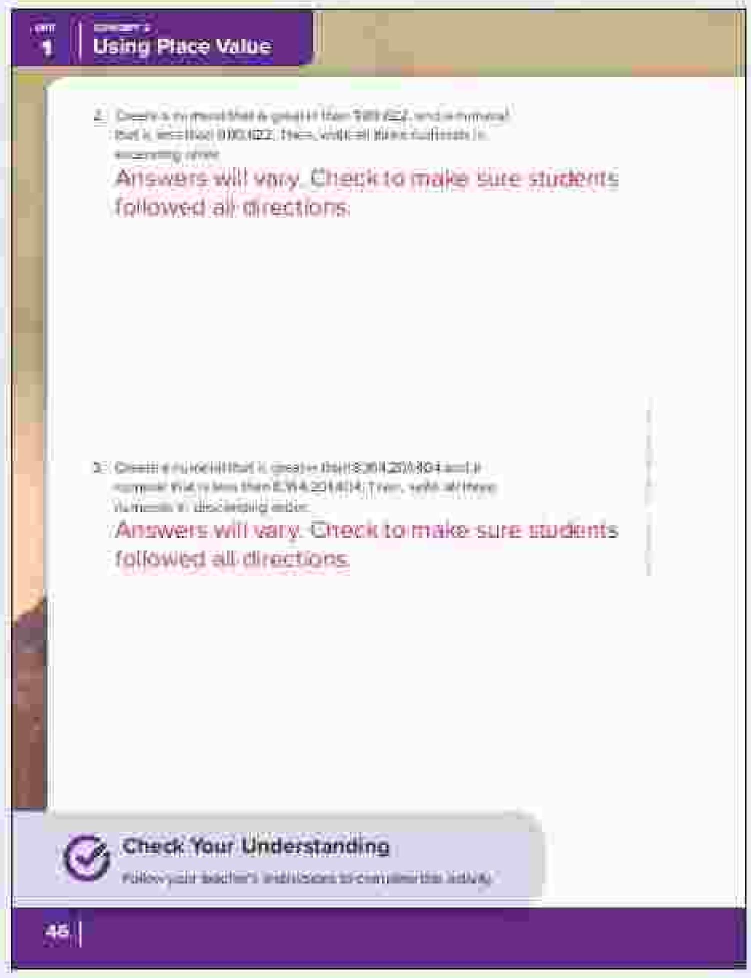
Standard Form	Descending Order
643,919	644,299
634,920	644,010
643,920	643,920
644,010	643,919
644,299	634,920

2. Create a numeral that is greater than 682,367, and a numeral that is less than 683,367. Then, write all three numerals in ascending order.
   Answers will vary. Check to make sure students followed all directions.

3. Create a numeral that is greater than 4,195,168 and a numeral that is less than 4,199,264,318. Then, write all three numerals in descending order.
   Answers will vary. Check to make sure students followed all directions.

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UNIT 1 | Using Place Value

Answers will vary. Check to make sure students followed all directions.

Answers will vary. Check to make sure students followed all directions.

Check Your Understanding

46

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LESSON 10
Predicting the Unpredictable

Lesson Overview

In this lesson, students shift the conversation on place value to the concept of estimation. They determine when an exact answer is needed and when an estimation is appropriate. This lesson also extends to very large numbers students' understanding and application of front-end estimation.

Lesson Essential Question

- How does estimating help me solve problems?

Learning Objectives

In this lesson

- Students will explain front-end estimation.
- Students will use front-end estimation to approximate large numbers.

Grade-Level Standards

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

estimation, front-end estimation, reasonable

Materials List

No additional materials are needed.

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle with knowing when to estimate and when an exact number is needed to solve a problem.
- Students may confuse front-end estimation with other rounding strategies.
- Students may not understand the value of determining the reasonableness of answers.

What Is Estimation?

1. Ask students to talk to a partner to define the word *estimate* and share what they remember about estimating from Primary 2 and Primary 3. Ask volunteers to share their thinking with the class.
2. Ask students to describe some situations when estimation might be useful. (Possible answers may include: when you are trying to figure out "about how much," when you are at the market and need to know about how much your groceries will cost, when you are trying to determine about how long something might take or about how far away something is.)
3. Make sure students know the following:
    - When we estimate, we find a value or answer that is close to the actual answer.
    - There are different strategies we can use to estimate.
    - Estimation can be used in situations in which an exact answer or number is not needed.
    - Estimation can help us determine whether or not our answer is reasonable.
4. Direct students to Lesson 10 ACCESS What is Estimation? and ask them to observe the image of an ant colony. Ask a volunteer read aloud the scenario.
5. Allow time for students to briefly discuss the questions with a partner or small group.
6. After a minute or so, have students share their thinking with the whole group.
   Answers may vary. That is acceptable at this time.

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LESSON 10

Predicting the Unpredictable

Learning Targets

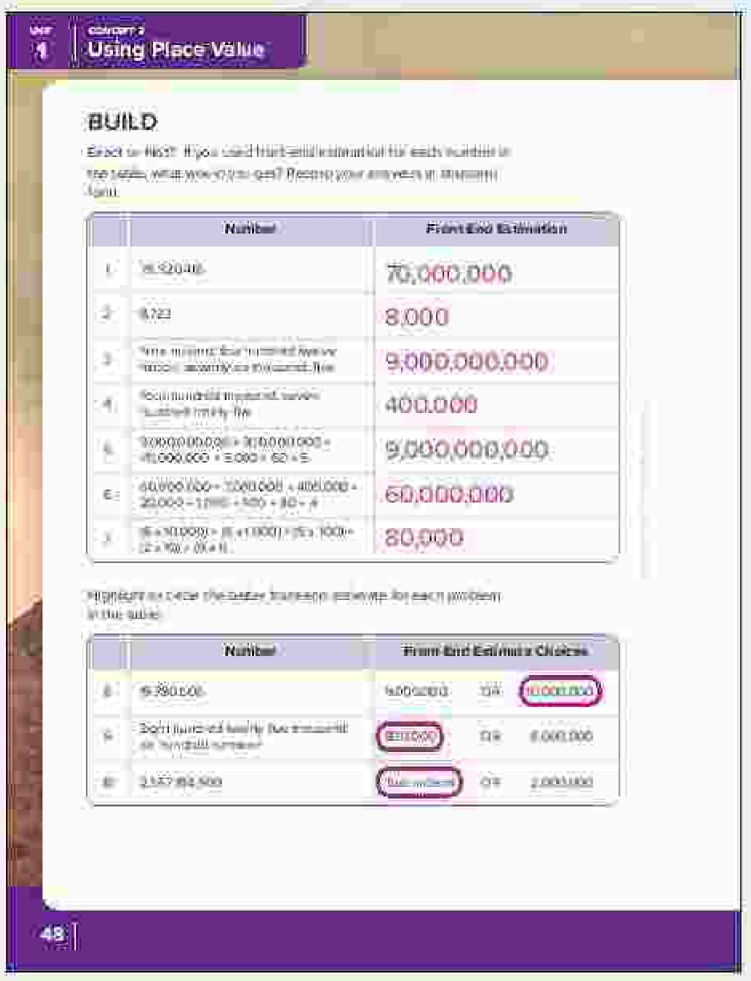
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Using Place Value

BUILD

[illegible]

	Number	Front-End Estimation
1	[illegible]	70,000,000
2	[illegible]	8,000
3	[illegible]	9,000,000,000
4	[illegible]	400,000
5	[illegible]	9,000,000,000
6	[illegible]	60,000,000
7	[illegible]	80,000

[illegible]

	Number	Front-End Estimate Choices		
8	[illegible]	[illegible]	OR	[illegible]
9	[illegible]	[illegible]	OR	[illegible]
10	[illegible]	[illegible]	OR	[illegible]

48

BUILD (40 min)

Exact or Not?

1. Tell students that there are times when they need an exact answer and times when an estimate is good enough.
2. Play Pop-Up to help students consider when it is okay to estimate and when they should find exact numbers.

   Directions
   - All students begin seated.
   - The teacher gives a scenario.
   - Students Pop-Up (stand) if they think the best way to solve the problem is through estimation.
   - The teacher calls on one student who Popped-Up and one who stayed seated to explain their reasoning.

   TEACHER NOTE: Some of these questions could be solved with exact numbers or estimation and this is important for students to understand.

   Scenarios
   - *Pop-Up if you could estimate how many balls are needed at recess.* (Yes)
   - *Pop-Up if you could estimate how many grams of flour you need to bake bread.* (No)
   - *Pop-up if you could estimate the amount you give to the store clerk.* (No)
   - *Pop-Up if you could estimate the amount of medicine to take for a cold.* (No)
   - *Pop-Up if you could estimate how many people would fit on a bus.* (Yes)
3. Ask students to work with a partner to create at least one more scenario that would require an exact answer and at least one more scenario where an estimate would suffice. (Students who finish early can create additional scenarios.)
4. If time permits, choose a few students to read their scenarios and play Pop-Up again.

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5. Ask students to talk to their Shoulder Partner about what they specifically remember about how to do front-end estimation. Call on students to share with the whole group. (Students may recall the following: front-end estimation gives them an approximate answer; in front-end estimation, they look only at the first digit in the number and each subsequent digit becomes a 0; this estimation strategy is not always accurate/does not consistently get close; front-end estimation is the simplest estimation strategy.)
6. Model a few front-end estimation problems on the board. Have students help you as much as possible. Remind students that they should keep the first number and turn the remaining numbers to zeroes. For example, 36 becomes 30; 492 becomes 400; and 71,999 becomes 70,000.
7. Have students work independently to complete the practice problems in Lesson 10 BUILD Exact or Not? Remind students to record their estimates in standard form.

CONNECT (7 min)

Writing About Math

Direct students to Lesson 10 CONNECT Writing About Math and ask them to respond to the prompt.

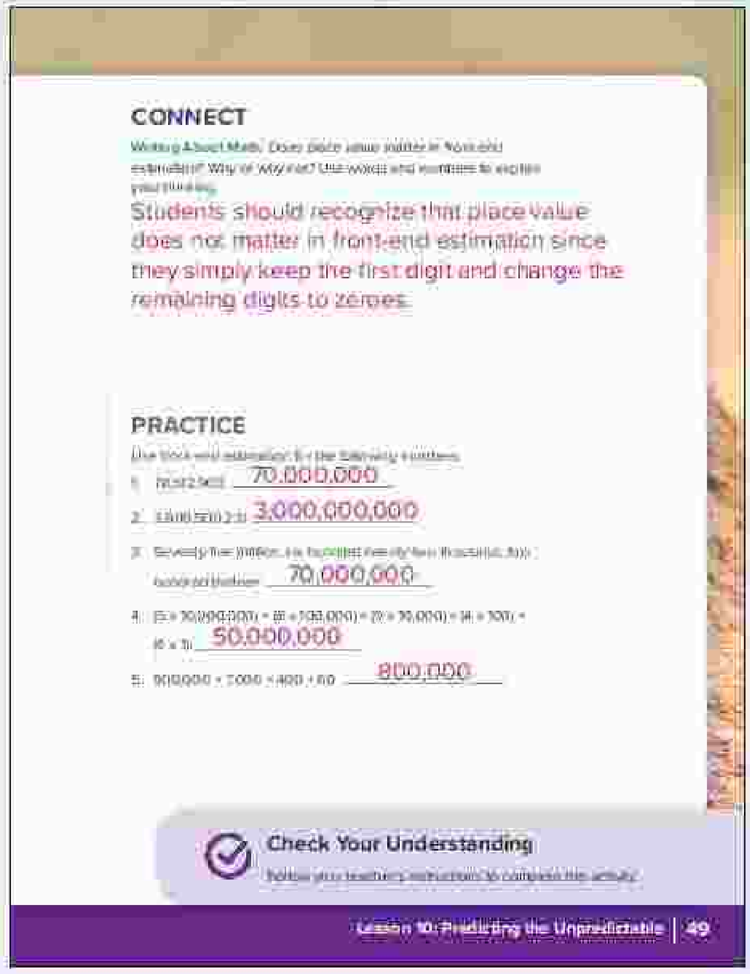
WRAP-UP (3 min)

Checking My Own Progress

1. Ask students to read the Learning Target for the lesson and reflect on how well they can meet the target right now.
2. Ask students to self-reflect using a Fist-to-Five, where "fist" indicates no understanding and "five fingers" indicates a deep understanding of all terms.
3. Remind students that they will continue to practice math skills as they learn new concepts and that they should always ask for help if they need it.

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CONNECT

Students should recognize that place value does not matter in front-end estimation since they simply keep the first digit and change the remaining digits to zeroes.

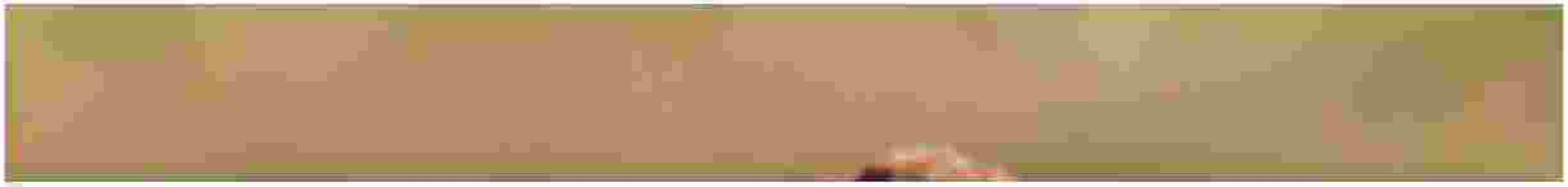
PRACTICE

1. 70,000,000
2. 3,000,000,000
3. 70,000,000
4. 50,000,000
5. 800,000

Check Your Understanding

Lesson 10: Predicting the Unpredictable | 49

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PRACTICE

Direct students to Lesson 10 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Define front-end estimation in your own words.
   Students should mention using the digit in the largest place in the numeral or the digit with the highest place value.

Use front-end estimation for the following numbers.

2. 86,433,920
   80,000,000

3. 6,627,513,202
   6,000,000,000

4. One hundred sixty-three million, four hundred thirty thousand, eight hundred two
   100,000,000

5. (9 × 1,000,000) + (2 × 100,000) + (7 × 10,000) + (3 × 100) + (6 × 1)
   9,000,000

6. 700,000 + 7,000 + 700 + 70 + 7
   700,000

LESSON 11
Rounding Rules

Lesson Overview

In this lesson, students apply their understanding of place value to rounding numbers. They discuss which process for estimation—rounding or front-end estimation—gives them a more accurate estimate.

Lesson Essential Question

- How can place value help us understand rounding?

Learning Objectives

In this lesson

- Students will apply multiple strategies to round numbers.
- Students will discuss whether rounding or front-end estimation provide a more accurate estimate.

Grade-Level Standards

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

accurate, estimation, nearest, reasonable, rounding

Materials List

- 2 sets of Large Digit Cards 0–9 (for the teacher)
- Rounding Rule on chart paper:
  Circle the digit, look next door.
  5 or higher? Add one more.
  4 or less? Let it rest.

Preparation

Write the Rounding Rule on chart paper in advance.

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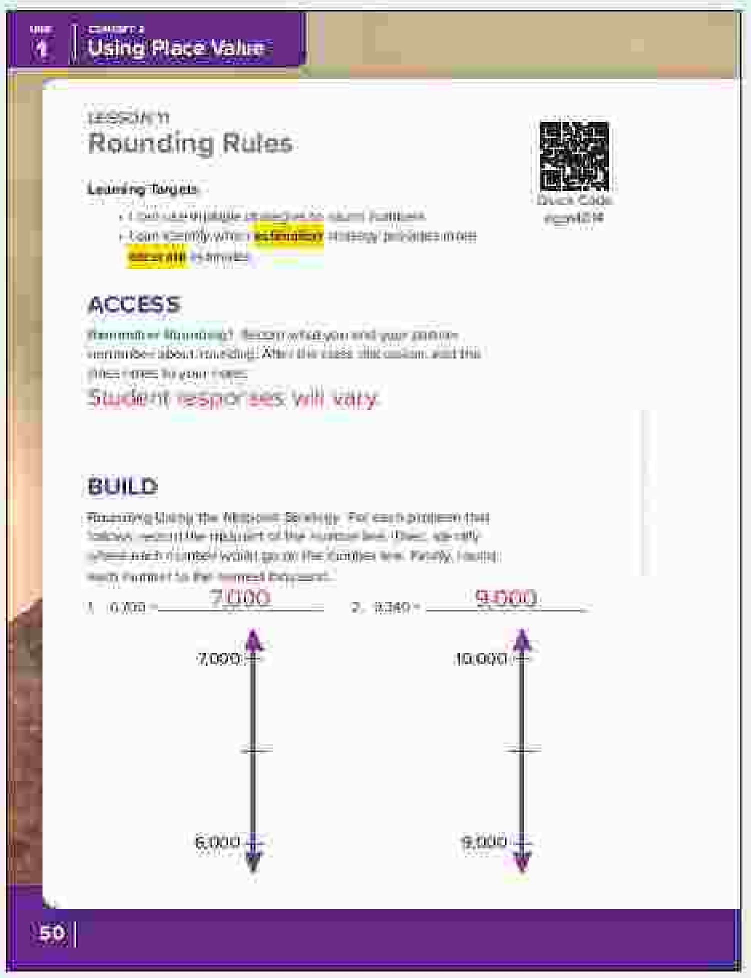
Lesson 11
Rounding Rules

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may misapply the rule for rounding down and actually lower the value of the digit in the designated place instead of keeping it the same or increasing it by one.
- Students may misapply the rule for rounding up and change the digit in the designated place, while not changing digits in smaller places to zeroes.
- Students often only use front-end estimation for determining the reasonableness of answers. Rounding provides more accurate estimates.

Remember Rounding?

1. Direct students to Lesson 11 ACCESS Remember Rounding and read the directions aloud. Students should talk with their Shoulder Partner about what they remember about rounding from Primary 3 and record their notes in their Student Materials.

2. Ask volunteers to share their thinking with the class. Record accurate ideas on the board. Engage students in a discussion about rounding, asking questions to help guide their thinking. Before moving on to BUILD, make sure the following concepts are recorded:
   - Rounding is a form of estimation.
   - Rounding can be used when an exact answer is not needed.
   - Rounding can get us closer to the actual answer than front-end estimation.
   - Rounding is similar to front-end estimation in that it changes a number to a shorter or simpler number that is close to the original.
   - Unlike front-end estimation, there are rules to rounding and the digit in the place you are rounding to may change.

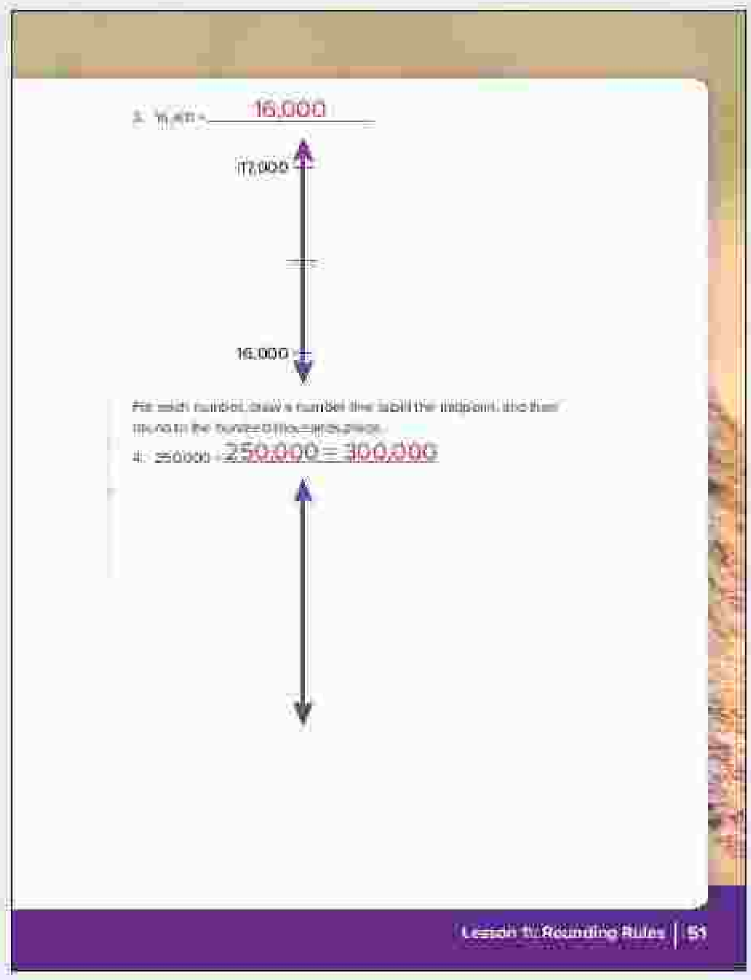
3. After the discussion, give students a few minutes to add the class notes to their notes. If time does not allow, leave the notes up so students can copy them later.

BUILD (40 min)

Rounding Using the Midpoint Strategy (20 min)

1. Draw a vertical number line on the board with 10 at the top and 0 at the bottom. Draw a midpoint, but do not label it.
2. Ask a volunteer to identify what number would be written on the midpoint of the number line. When it is correctly identified, label the number line.
3. Ask students where they would put 8 on the number line. Have a volunteer mark and record 8 on the number line. Have them explain their reasoning.
4. Repeat the process with 5,000 and 4,000.
5. Once the midpoint is labeled, ask students where they would put the number 4,675 on the number line. Have a volunteer record where the number should go on the vertical number line. Have them explain their reasoning.
6. Point out that 4,000 is at the bottom of the number line and 5,000 is at the top of the number line. Use Calling Sticks to ask if 4,675 which Thousand 4,675 is nearest to. Ask students to explain how the vertical number line and the midpoint helps them place numbers on the number line.
7. Explain to students that they just rounded 4,675 to the nearest Thousand. On the number line 4,675 was nearest to 5,000, so we rounded it up to 5,000.
8. Record another vertical number line on the board with 20,000 at the bottom and 30,000 at the top with 25,000 as the midpoint. Ask volunteers to show where they think 23,400 should go on the number line. Have students explain their reasoning.
9. Next, ask students to Turn and Talk about which Ten Thousand 23,400 is nearest to—20,000 or 30,000. Discuss. Confirm that 20,000 is the nearest Ten Thousand, so we would round 23,400 down to 20,000.

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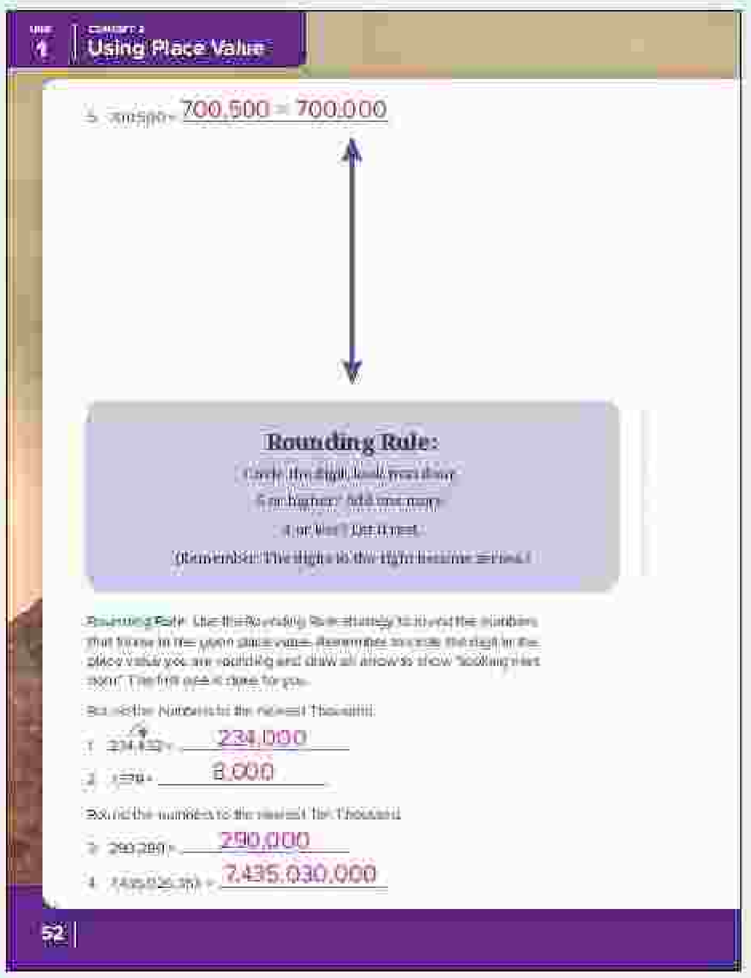


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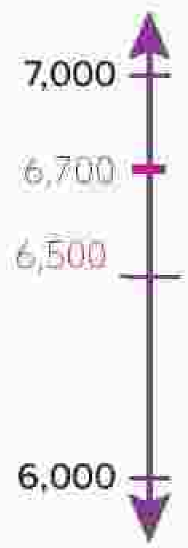
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10. Direct students to Lesson 11 BUILD Rounding Using the Midpoint Strategy and ask them to work with a partner to solve Problems 1–5. If students appear to be struggling, regroup the whole class and work together to solve the problems. Be sure to discuss Problem 4, where the number is exactly at the midpoint.
11. After about seven minutes, go over the answers together and clarify any confusion.

Student Number Lines:

1. 6,700 ≈ 7,000



2. 9,340 ≈ 9,000



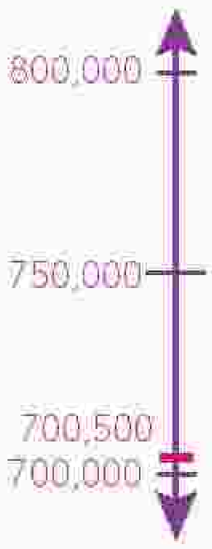
3. 16,401 ≈ 16,000



4. 250,000 ≈ 300,000



5. 700,500 ≈ 700,000



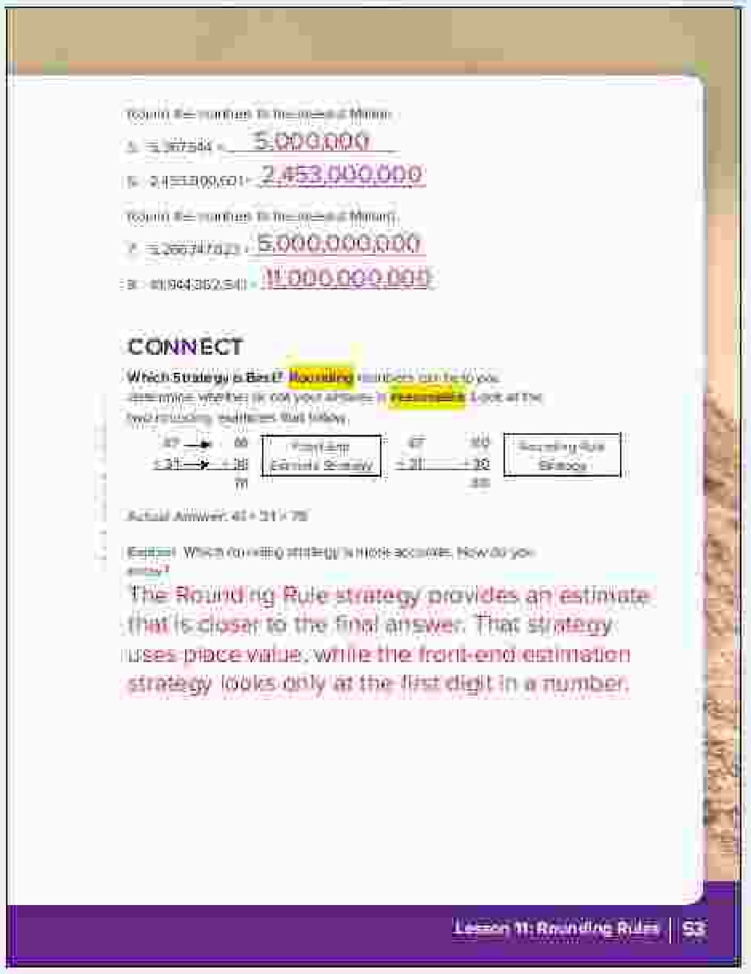
Rounding Rule (20 min)

1. Explain that knowing the midpoint is a good tool for rounding, but there are other strategies that they may find more helpful.
2. Have two sets of large digit cards 0–9. Ask for 4 volunteers to come to the front of the room. Give each student a card and have them stand in a line to create the numeral 4,675.
3. Tell students we want to round the number to the nearest Thousand. Ask students to identify which student is in that place. Have that student step forward.
4. Next, display the Rounding Rule and read it aloud.
5. Point to the 4 in the Thousands place and model looking "next door," by having the student holding the 4 look at the student in the Hundreds place. Ask students to repeat the rule and then decide if the 4 should add one more or let it rest and stay the same. (Students should recognize they need to add one more to the digit in the Thousands place.)
6. Remind students that earlier they used the midpoint to help them determine that 4,675 was closer to 5,000. The Rounding Rule tells us that, too, since it tells us we should add one more to the Thousands place and then all the other places become zeros.
7. Repeat the activity using the numbers 4,123 (nearest Thousand), 13,457 (nearest Thousand and nearest Hundred), and 256,962 (nearest Ten Thousand and nearest Ten).
8. Debrief the activity highlighting the connection between the midpoint strategy and the Rounding Rule strategy.
9. Have students turn to Lesson 11 BUILD Rounding Rule to practice rounding using the Rounding Rule strategy. Depending on their readiness, students may work independently, in pairs, or in small groups.



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CONNECT (5 min)

Which Strategy Is Best?

Direct students to Lesson 11 CONNECT Which Strategy Is Best? Ask students to read the statement about rounding and discuss as a whole group.

WRAP-UP (5 min)

Place Value and Rounding

1. Ask students to talk to a partner about the following question: Does place value matter in rounding? Why or why not?
2. After a minute, ask volunteers to share their ideas. Place value plays an important role in rounding because it requires them to look at the place they are rounding to and at the digit in the place to the right. Otherwise, they will not be able to round numbers accurately.

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PRACTICE

Direct students to Lesson 11 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Use the Rounding Rule strategy to solve the problems below. Remember to circle the digit you are rounding to.

Round the numbers below to the Thousands place.

1. 9,621 ≈ 10,000
2. 42,502 ≈ 43,000
3. 824,157 ≈ 824,000

Round the numbers below to the Hundreds place.

4. 10,671 ≈ 10,700
5. 423,502 ≈ 423,500
6. 1,632,542 ≈ 1,632,500
7. Highlight or circle the number that shows 1,236,532,748 rounded to the Ten Millions place.

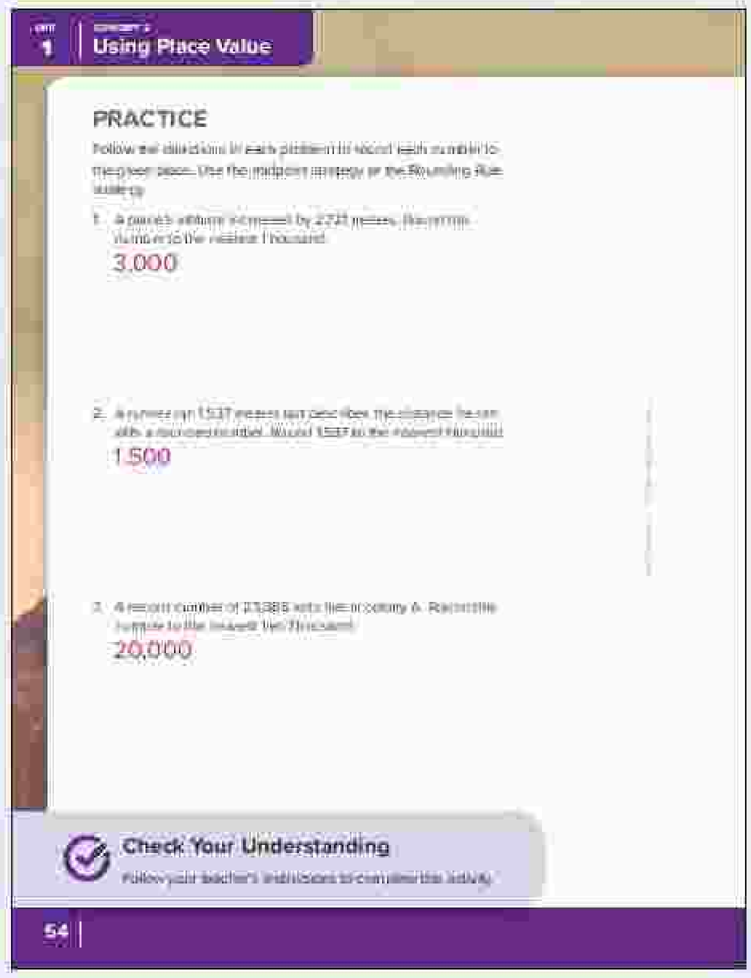
   1,230,000,000   (1,240,000,000)

8. Highlight or circle the number that shows 1,436,532,748 rounded to the Milliards place.

   (1,000,000,000)   2,000,000,000

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UNIT 1 | Using Place Value

PRACTICE

1. 3,000
2. 1,500
3. 20,000

Check Your Understanding

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Materials List

Materials may vary.

DIGITAL



Concept Check-In and Remediation

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2: Using Place Value. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Concept Essential Questions

- How can we efficiently compare and order very large numbers?
- How can understanding place value help us order very large numbers?
- How does estimating help me solve problems?
- How can place value help us understand rounding?

Learning Objectives

In this lesson

- Students will work to correct misconceptions and errors related to comparing, ordering, and rounding numbers.

Grade-Level Standards

4.A.1.c Read and write numbers up to a milliard (billion) using numerals, word form, and expanded form.

4.A.1.d Use place value understanding to round multi-digit whole numbers up to the Milliards (Billions) place.

4.A.1.e Order a set of numbers up to the Milliards place.

4.A.1.f Compare two multi-digit numbers using the symbols <, >, = to express the relationship.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- Students do not often consider how many digits are in a numeral when they compare.
- Students may struggle with comparing numbers in word form or expanded notation.
- Students may struggle with finding a system that helps them compare numbers in different forms.
- Students may not understand the place value relationships between the standard, word, and expanded forms of a number.
- Students may struggle to compare and order numbers with similar digits and need to be reminded to start on the left and compare each digit while moving to the right of a number.
- Students may struggle with knowing when to estimate and when an exact number is needed to solve a problem.
- Students may misapply the rule for rounding down and actually lower the value of the digit in the designated place instead of keeping it the same or increasing it by one.
- Students may misapply the rule for rounding up and change the digit in the designated place, while not changing digits in smaller places to zeroes.

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Remediation: Correcting Misconceptions

If...	Then...
Students struggle with comparing numbers in word form or expanded notation.	Review Strategies for Comparison in Lesson 8. Consider having students convert numbers to standard form before comparing them. Help students understand the relationships between standard form, word form, and expanded form. Use a place value chart to help them see the relationships.
If...	**Then...**
Students struggle to compare and order numbers with similar digits and need to be reminded to start on the left and compare each digit while moving to the right of a number.	Review Lesson 9. Consider engaging students in a hands-on activity in which they represent the digits in the numbers they are comparing. In the activity, students holding a digit in the same place can step forward and compare their numbers.
If...	**Then...**
Students do not understand that the digits to the right of the rounded place all become zeros.	Review Lesson 11. Consider engaging students in additional hands-on practice in which they represent the digits in the numbers they are rounding. In the activity, the student standing in the place they are rounding to can step forward, students can make a rounding decision, and the remaining numbers can turn their cards over to change to zeroes.

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UNIT

2

ADDITION AND SUBTRACTION STRATEGIES

Theme 1 | Number Sense and Operations

Unit 2 Addition and Subtraction Strategies

ESSENTIAL QUESTIONS

- Do the properties of addition apply to subtraction? Why or why not?
- Why is it important to be able to add and subtract mentally?
- Which mental math strategies are the most efficient?
- How can estimation help to solve problems accurately?
- What are the different ways to add?
- Which addition strategies are the most efficient?
- What are the different ways to subtract?
- Which subtraction strategies are the most efficient?



Video Questions

The Unit 2 Opener Video, Calculation Ants, uses facts about ant colonies to introduce operations on large numbers. Omar and Mariam are investigating ant movement in and out of the ant mound. Soon they may need a faster way to add and subtract.

- How can we use patterns to determine strategies?
- What are some patterns you have observed this week?

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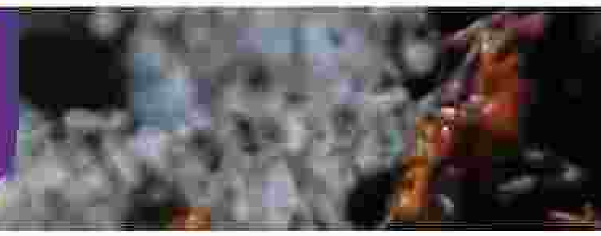
Key Vocabulary

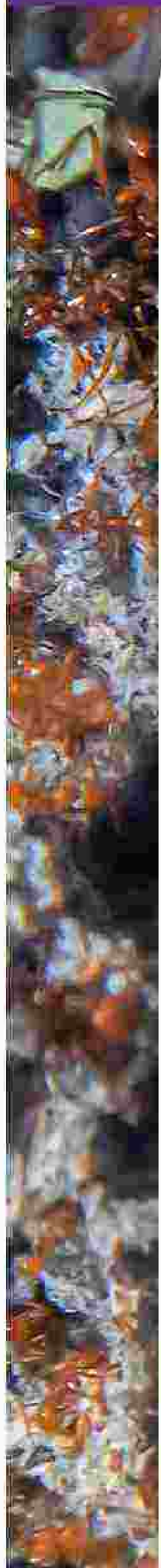
As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

addend, Additive Identity Property, Associative Property, Commutative Property, minuend, property, subtrahend

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Unit Storyline

Unit 2 Addition and Subtraction Strategies Storyline

The Addition and Subtraction Strategies unit extends students' working knowledge of whole numbers and the place value system in the context of addition and subtraction. Students apply these understandings to develop strategies for efficient mental math and estimation. Students observe video of ants to support learning and enhance their knowledge of addition and subtraction properties.

Unit Standards

4.A.2	Use place value understanding and properties of operations to perform multi-digit arithmetic.
4.A.2.a	Fluently add and subtract multi-digit whole numbers.
4.C.1.d	Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.
4.C.1.d.1	Use letters in equations to represent unknown quantities.
4.C.1.e	Assess the reasonableness of answers using mental computation.

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Unit 2 Structure and Pacing

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.

Concept 1: Using Addition and Subtraction Strategies

Essential Questions

- Do the properties of addition apply to subtraction? Why or why not?
- Why is it important to be able to add and subtract mentally?
- Which mental math strategies are the most efficient?
- How can estimation help to solve problems accurately?
- What are the different ways to add?
- Which addition strategies are the most efficient?
- What are the different ways to subtract?
- Which subtraction strategies are the most efficient?

Lesson 1

Properties of Addition

Learning Objectives

- Students will identify the properties of addition and subtraction.
- Students will explain the properties of addition and subtraction.
- Students will investigate to determine whether the properties of addition apply to subtraction.

Student Learning Targets

- I can identify the properties of addition.
- I can explain the properties of addition.
- I can investigate to determine if addition properties apply to subtraction.

Lesson 2

Review Mental Math Strategies

Learning Objectives

- Students will apply a variety of strategies to add and subtract mentally.
- Students will explain the importance of mental math skills.

Student Learning Targets

- I can apply a variety of strategies to add and subtract mentally.
- I can explain why it is important to be able to do mental math.

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Unit Structure and Pacing *cont'd*

Lesson 3	**Addition with Regrouping** **Learning Objectives** • Students will add multidigit whole numbers. • Students will estimate to determine if their answer is reasonable. **Student Learning Targets** • I can add multidigit whole numbers. • I can estimate to check the reasonableness of my answers.
Lesson 4	**Subtraction Strategies** **Learning Objectives** • Students will use decomposition of numbers to subtract multidigit whole numbers. • Students will explain the importance of finding patterns and relationships in mathematics. **Student Learning Targets** • I can use place value to decompose numbers in order to subtract. • I can explain the importance of finding patterns and relationships to solve problems.
Lesson 5	**Subtraction with Regrouping** **Learning Objective** • Students will use place value to subtract using the standard algorithm. • Students will subtract with regrouping. • Students will estimate to check the reasonableness of their answers. **Student Learning Target** • I can use place value to help me subtract with regrouping. • I can estimate to check the reasonableness of my answers.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to using addition and subtraction strategies. **Student Learning Target** • I can correct my misconceptions and errors related to using addition and subtraction strategies.



Concept 2: Solving Multistep Problems **Essential Questions** • What are the different ways to add and subtract? • Which strategies are the most efficient? • How can estimation help me solve problems accurately?	
Lesson 6	**Bar Models, Variables, and Story Problems** **Learning Objectives** • Students will use letters to represent unknown quantities in equations. • Students will use bar models to represent and solve story problems. • Students will solve for the variable in an equation. **Student Learning Targets** • I can use letters to represent unknown quantities in equations. • I can use bar models to represent and solve story problems. • I can solve equations that include variables.
Lesson 7	**Solving Multistep Story Problems with Addition and Subtraction** **Learning Objectives** • Students will solve multistep story problems. • Students will explain how they solved multistep story problems. **Student Learning Targets** • I can solve multistep story problems. • I can explain how I solved multistep story problems.
	Concept Check-In and Remediation **Learning Objectives** • Students will work to correct misconceptions and errors related to solving multistep problems. **Student Learning Target** • I can correct my misconceptions and errors related to solving multistep problems.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

Reduce ACCESS by 3 minutes

Reduce BUILD by 8 minutes

Reduce CONNECT by 2 minutes

Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section include

- discussing fewer examples
- eliminating Shoulder Partner conversations
- shortening class discussions
- working with students to complete ACCESS problems

If Mathematics instruction is based on 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

Follow the 45-minute approach for the 45-minute days

Teach two 45-minute lessons on the 90-minute day

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

Increase ACCESS by 5 minutes

Increase BUILD by 20 minutes

Increase CONNECT by 3 minutes

Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section include

- discussing additional examples as needed
- extending class discussions
- allowing time for hands-on work with manipulatives and models
- providing additional practice problems for students who need additional practice
- encouraging students to share and model their problem-solving strategies

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Mathematical Background Knowledge

Using Addition and Subtraction Strategies

In this unit, students learn many strategies to solve addition problems, as well as understand properties of multiplication, which mirror those of addition. As students move to Primary 5, they apply these same properties to decimals and fractions. Understanding the properties of addition allows students to see that equations can be flexible. For example, there is more than one way to write an addition equation. This understanding paves the way for a stronger number sense, as students learn to manipulate equations to make them simpler to solve. An example of this might be a problem such as 7 + 15 + 3. With an understanding of the Commutative Property, students may choose to combine the 7 and 3 first to make a benchmark number (10) and then add the 15. This may be more efficient than solving the problem from left to right as originally written. Having multiple mental math strategies aids in computation as well as demonstrates a strong number sense.

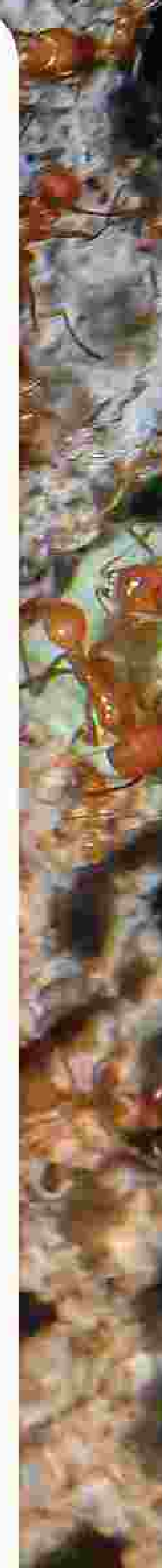
In Primary 3, students created and explained strategies for solving addition problems. They also learned the formal algorithm and how to regroup numbers larger than 10. They estimated their answers as both a way to predict the sum and as a way to check their completed work. Students apply these strategies again in Primary 5 when they add and subtract decimals up to the thousandths place. Decomposing numbers was taught in Unit 1 of Primary 4 and is used in this lesson to decompose numbers in order to effectively subtract. In Primary 5, students will apply these same strategies as they work with decimals.

In Primary 4, students continue to gain fluency with the standard algorithm solving bare number problems with up to seven digits. In Primary 5, students apply their understanding of place value and the standard algorithm to whole numbers and decimals.

Solving Multistep Problems

In Primary 3, students were introduced to the concept of symbols representing unknown quantities in equations. They used number bonds and bar models to help solve for an unknown. Students also learned that the equal sign shows that numbers on both sides of an equation are balanced. In Primary 4, students use variables to represent unknown quantities in equations. This early algebraic concept transfers to Primary 5 and beyond.

In Primary 3, students solved multistep story problems using all four operations. In Primary 4, students write equations to represent story problems involving a variety of operations, using variables to represent unknowns. Students use mathematical terminology to explain why they chose their problem-solving strategies.



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CONCEPT

1

Using Addition and Subtraction Strategies

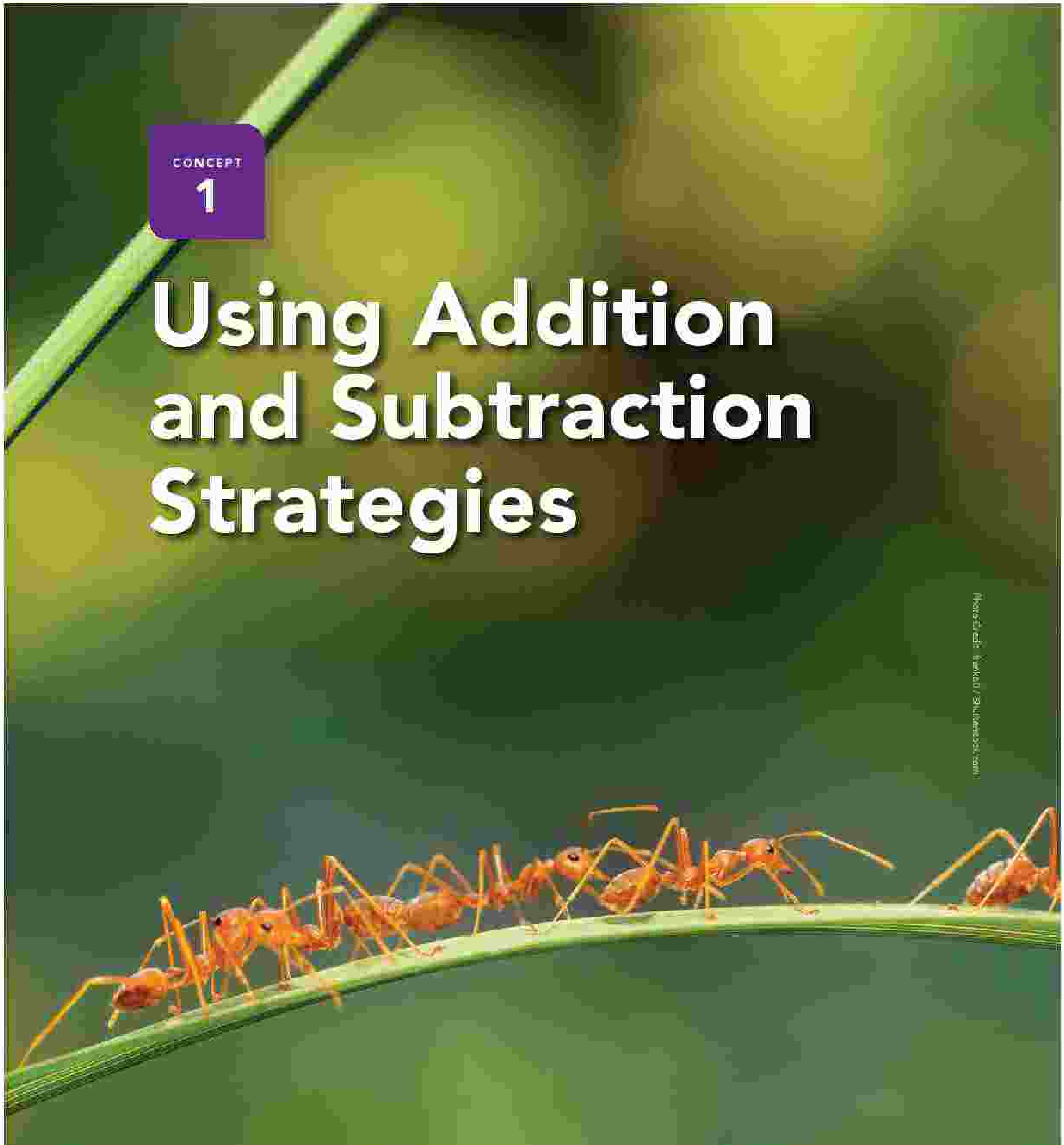


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Concept Overview

In Concept 1: Using Addition and Subtraction Strategies, students review and explore addition and subtraction strategies, including mental math strategies and the standard addition and subtraction algorithms. This work helps prepare students for working with larger numbers and provides context for the importance of estimating to check the reasonableness of answers. Although instruction in addition and subtraction strategies does not explicitly continue after Unit 2, students should continue to practice throughout the year in a variety of contexts, including bare number problems, story problems, math projects, and assessments.

Concept Standards

4.A.2 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.A.2.a Fluently add and subtract multi-digit whole numbers.

4.C.1.d Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation.



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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Properties of Addition	• Properties of Addition anchor chart on chart paper (See the example at the end of the volume.) • Mathematics Tool Kit anchor chart on chart paper (See the example at the end of the volume.)	Addend Additive Identity Property Associative Property Commutative Property Minuend Property Subtrahend	• Students will identify the properties of addition and subtraction. • Students will explain the properties of addition and subtraction. • Students will investigate to determine whether the properties of addition apply to subtraction.	
2 Review Mental Math Strategies	• Mental Math Strategies anchor chart • Thinking Like a Mathematician anchor chart	Benchmark numbers Estimate Mental math Round	• Students will apply a variety of strategies to add and subtract mentally. • Students will explain the importance of mental math skills.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not understand that, although the order of numbers does not matter in an addition problem, it matters greatly and changes the answer in a subtraction problem. • Students may struggle to remember the difference between the Associative and Commutative Properties.	Do the Properties Apply?, Writing About Math, Practice, Check Your Understanding
	• When using compensation to mentally add and subtract, students are often unclear how to balance the amount compensated.	Mental Math Strategies, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
3 Addition with Regrouping	• No additional materials needed	Algorithm	• Students will add multidigit whole numbers. • Students will estimate to determine if their answer is reasonable.	
4 Subtraction Strategies	• Mental Math Strategies anchor chart (Prior to the lesson, add the strategies Counting Back with Decomposition and Counting Up with Decomposition to the anchor chart.) • Thinking Like a Mathematician anchor chart	Difference Minuend Subtrahend	• Students will use decomposition of numbers to subtract multidigit whole numbers. • Students will explain the importance of finding patterns and relationships in mathematics.	
5 Subtraction with Regrouping	• Draw a place value chart on the board showing Thousands and Ones periods. • Label four sheets of paper with a subtraction strategy: o Standard Subtraction Algorithm o Counting Up with Decomposition o Counting Down with Decomposition o Other strategy	Algorithm Regroup	• Students will use place value to subtract using the standard algorithm. • Students will subtract with regrouping. • Students will estimate to check the reasonableness of their answers.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may struggle with regrouping whether using the standard algorithm or decomposing by place value. • Students may always start a number line at 0. In problems that use large numbers, it is important to start a number line with numbers other than 0.	Error Analysis, Estimate and Solve, Bridging Ants and Addition, Practice, Check Your Understanding
	• Students may struggle with decomposing numbers in ways that make sense to them. • Students may struggle with where to place numbers on an open number line.	Exploring Subtraction Strategies, Writing About Math, Practice, Check Your Understanding
	• Students may struggle to understand the standard algorithm for subtraction when regrouping is required. They do not decompose into smaller units to solve. • Students tend to model both the subtrahend and minuend instead of recognizing that the minuend is the only number to model since the subtrahend will be taken away from that larger number.	Error Analysis, Ant Facts and Algorithms, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to using addition and subtraction strategies.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not understand that, although the order of numbers does not matter in an addition problem, it matters greatly and changes the answer with a subtraction problem. • Students may struggle to remember the difference between the Associative and Commutative Properties. • When using compensation to mentally add and subtract, students are often unclear how to balance the amount compensated. • When regrouping, students may struggle with whether to use the standard algorithm or decompose by place value. • Students may struggle with decomposing numbers in ways that make mental math easier.	Concept Check-In

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LESSON 1
Properties of Addition

Lesson Overview

In this lesson, students learn the Commutative, Associative, and Additive Identity Properties of Addition. They build understanding of each property, learn how the properties help them solve addition problems, and apply each property to create and solve equations. They also investigate whether the same properties apply to subtraction, confirming or refining their predictions afterward.

Lesson Essential Question

- Do the properties of addition apply to subtraction? Why or why not?

Learning Objectives

In this lesson

- Students will identify the properties of addition and subtraction.
- Students will explain the properties of addition and subtraction.
- Students will investigate to determine whether the properties of addition apply to subtraction.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.A.2.a Fluently add and subtract multidigit whole numbers.

Vocabulary Check-In

addend, Additive Identity Property, Associative Property, Commutative Property, minuend, property, subtrahend

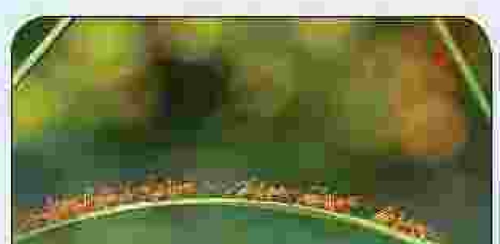
Materials List

- Properties of Addition anchor chart on chart paper (see the example at the end of this volume)
- Mathematics Tool Kit anchor chart on chart paper (see the example at the end of this volume)

Preparation

Photocopy the Blackline Master at the end of this volume.

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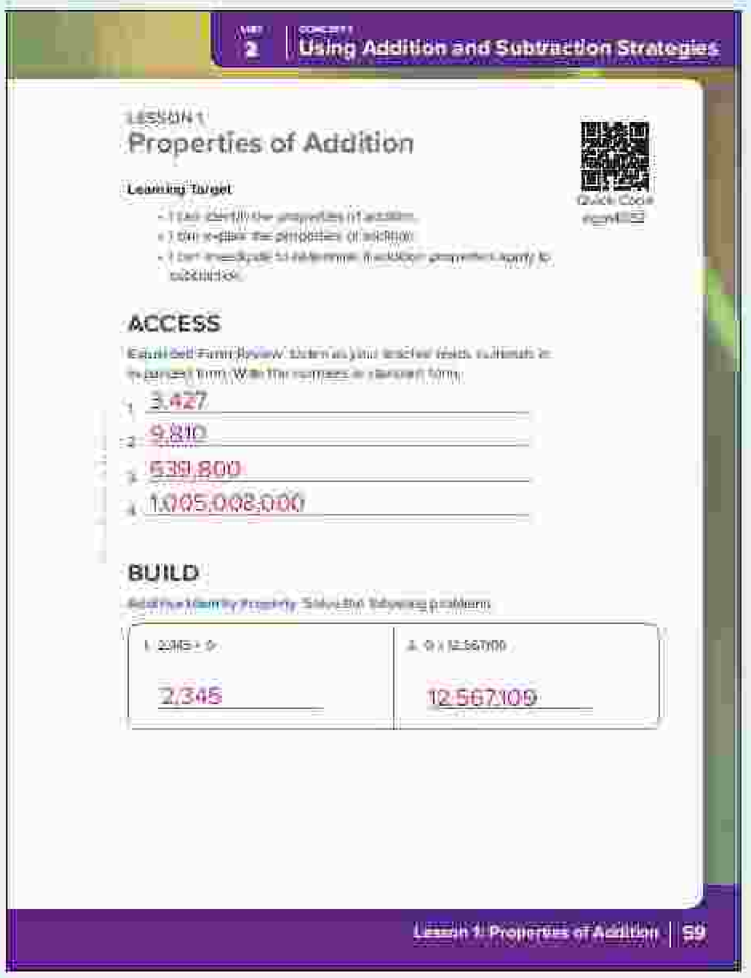


Lesson 1
Properties of Addition

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2 Using Addition and Subtraction Strategies

LESSON 1

Properties of Addition

Learning Target

ACCESS

1. 3,427
2. 9,810
3. 639,800
4. 1,005,008,000

BUILD

1. 2,345
2. 12,567,109

Lesson 1: Properties of Addition | 59

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that, although the order of numbers does not matter in an addition problem, it matters greatly and changes the answer in a subtraction problem.
- Students may struggle to remember the difference between the Associative and Commutative Properties.

Expanded Form Review

1. Explain to students that in this unit they will use what they have learned about rounding and number forms and apply it to addition and subtraction.
2. Ask students to turn to Lesson 1 ACCESS Expanded Form Review in their Student Materials.
3. Read the following numbers aloud and ask students to write them in standard form.
   1. 3,000 + 400 + 20 + 7
   2. 9,000 + 800 + 10
   3. 600,000 + 30,000 + 9,000 + 800
   4. 1,000,000,000 + 5,000,000 + 8,000
4. Go over the answers as a class. Tell students that breaking numbers into place value is a skill they will use during addition.

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BUILD (40 min)

Additive Identity Property (10 min)

1. Tell students that in mathematics, properties are characteristics that belong to a set of numbers. Properties are always true, so a property of addition will always be true.

2. Ask students to turn to Lesson 1 BUILD Additive Identity Property. Ask students to share what they know about the number zero. Possible answers include that it can be a placeholder, it can represent the absence of a number, and it can change the value of the digits to the left of it, such as 8, 80, 800.

3. Ask students to solve Problems 1–4.

4. Go over the answers with the class. Ask students to discuss what they noticed about the problems and their solutions and the definitions they wrote. Students should notice that any number added to 0 will always equal that number. Correct any misconceptions and ask students to revise their work if needed.

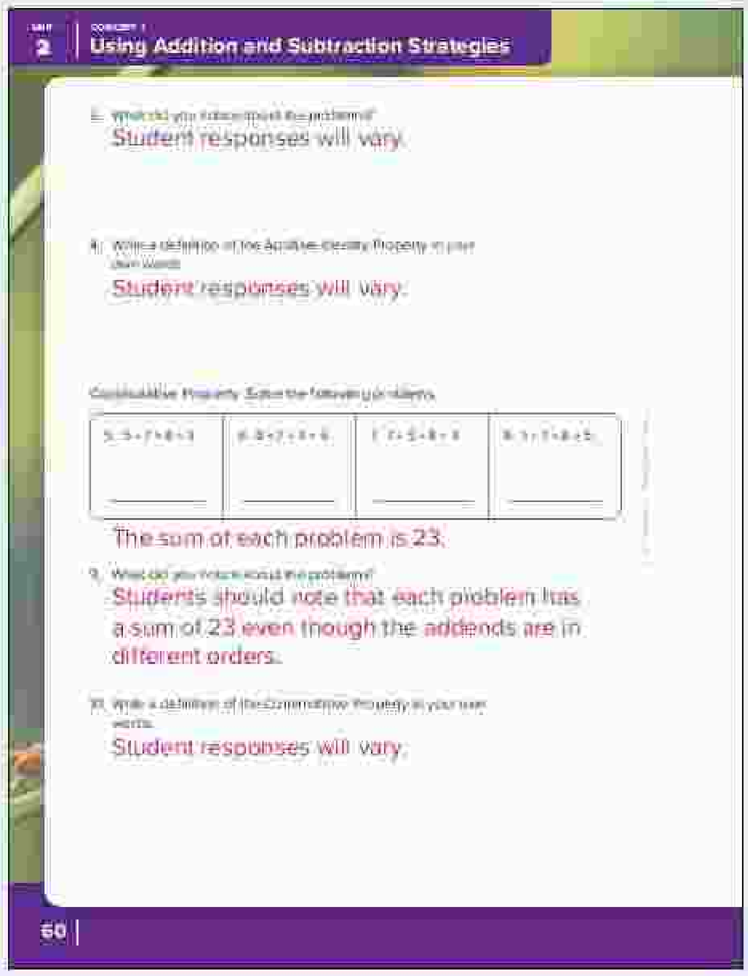
Commutative Property and Associative Property (10 min)

5. Repeat the process for the Commutative Property (Problems 5–10) and Associative Property (Problems 11–15). Make sure that students recognize the following:

    - The Commutative Property of Addition states that addends can be combined in any order and the answer will remain the same.
    - The Associative Property of Addition states that addends can be grouped in any way and the sum will remain the same.

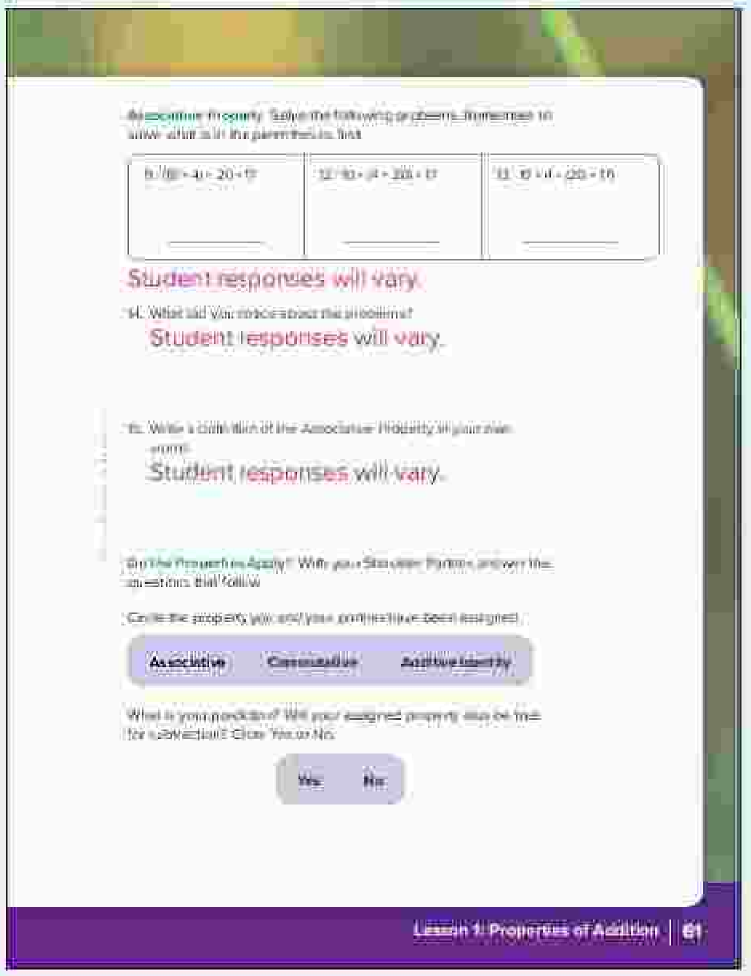
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TEACHER NOTE If students need additional practice with the properties of addition, have volunteers come to the front of the class and model the problems. For example, if the problem was 5 + 2 + 3, have one group of 5, one group of 2, and one group of 3. Note that as they change their relationship with each other (rearranging the groups), the total sum of students remains the same.

Do the Properties Apply? (20 min)

1. Ask students to discuss the following questions with their Shoulder Partner and give a Thumbs Up when they are ready to share.

ASK

- *Do you think these properties apply to subtraction problems?*
- *How can we figure out whether or not they do?*

2. Call on students to share their thinking with the class. Explain to students that they will be investigating to see if the properties of addition also apply to subtraction.
3. Ask students to turn to Lesson 1 BUILD Do the Properties Apply? Point out to students the number line they may use to help them solve the problems, if needed.
4. Assign each pair of Shoulder Partners a property (Additive Identity, Commutative, or Associative). Each pair of students should do the following:
   - Highlight or circle their assigned property.
   - Make a prediction about whether their assigned property applies to subtraction.
   - Create a simple subtraction problem (using numbers 0–10) to test their prediction.
   - Draw a conclusion.
   - Explain their conclusion.
5. Give students time to work with their partner to complete their investigation.

TEACHER NOTE If students do not remember how to use a number line, review with simple problems

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written on the board and practice as a class. Select some problems whose difference is less than 0, like 12 – 15. Tell students that any number less than zero is negative. This is NOT an important concept for Primary 4 students to master or apply. If students indicate "a number less than zero" or that the number "went past zero," that is acceptable.

6. When students are finished, ask volunteers to share their results. Students should see that these properties do not apply to subtraction because, when the order of the numbers changes, the differences are not equivalent to the differences of the original subtraction problem.
   - Examples
     - Additive Identity: 6 – 0 = 6, but 0 – 6 equals a number less than 0
     - Commutative: 2 + 3 + 5 = 10 and 3 + 2 + 5 = 10 but 5 – 2 – 3 = 0 and 2 – 3 – 5 equals a number less than 0
     - Associative: (2 + 3) + 5 = 10 and 2 + (3 + 5) = 10 but (5 – 2) – 3 = 0 and 5 – (2 – 3) = 6

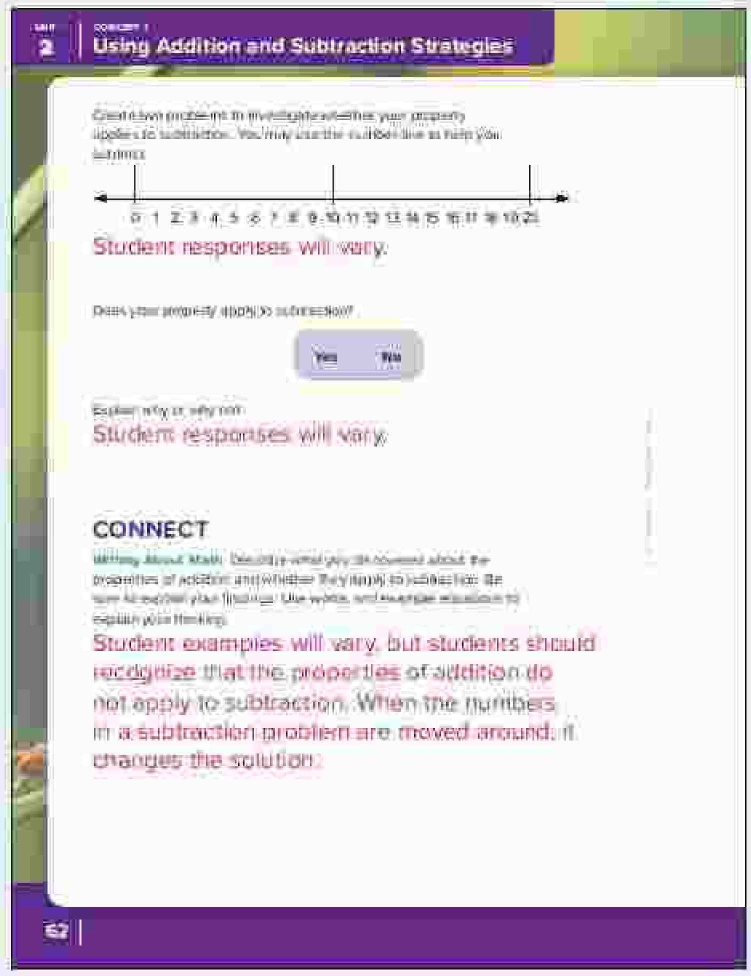
CONNECT (7 min)

Writing About Math

Direct students to Lesson 1 CONNECT Writing About Math and ask them to respond to the prompt.

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UNIT 2 | CONCEPT 1
Using Addition and Subtraction Strategies

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Student responses will vary.

Yes No

Student responses will vary.

CONNECT

Student examples will vary, but students should recognize that the properties of addition do not apply to subtraction. When the numbers in a subtraction problem are moved around, it changes the solution.

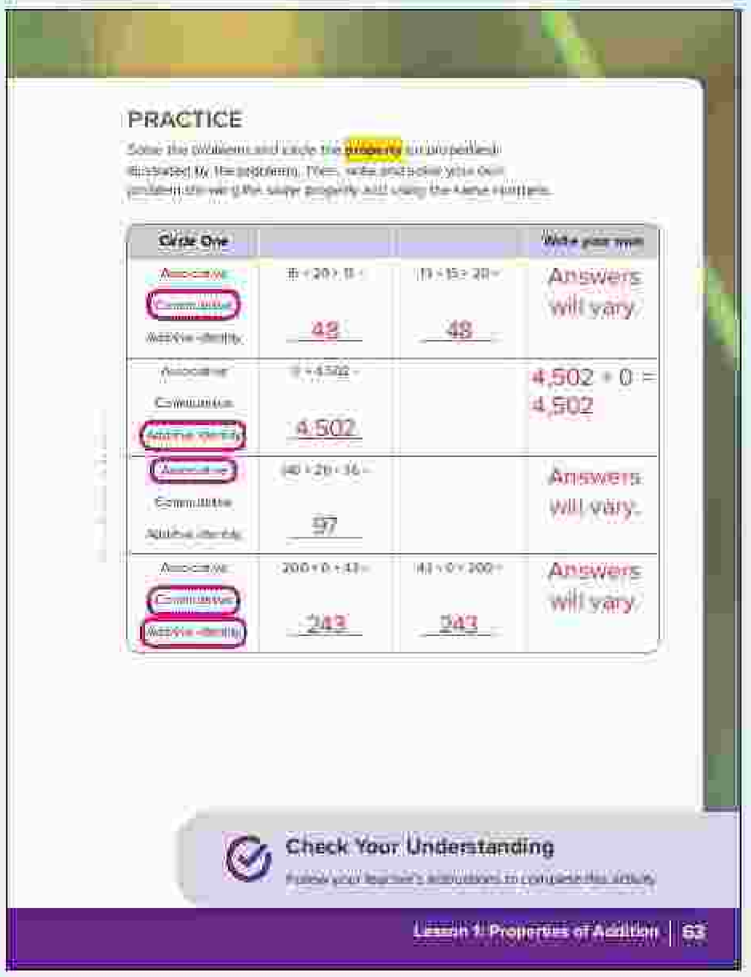
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PRACTICE

Solve the problems and circle the property or properties illustrated by the problems. Then, write and solve your own problem showing the same property and using the same numbers.

Circle One			Write your own
Associative / **Commutative** / Additive Identity	[illegible] = 48	[illegible] = 48	Answers will vary.
Associative / Commutative / **Additive Identity**	0 + 4,502 = 4,502		4,502 + 0 = 4,502
Associative / Commutative / Additive Identity	[illegible] = 97		Answers will vary.
Associative / **Commutative** / **Additive Identity**	200 + 0 + 43 = 243	43 + 0 + 200 = 243	Answers will vary.

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 1: Properties of Addition | 63

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask student volunteers to share their responses to the Writing About Math prompt and explain their thinking. Encourage students to ask each other questions and request clarification and examples.

PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve the problems. Then list the property illustrated by each problem (Additive Identity, Commutative, or Associative).

1. 18 + 34 + 20 = 72 Property: Commutative
2. (20 + 37) + 40 = 97 Property: Associative
3. 56,248 + 0 = 56,248 Property: Additive Identity
4. 50 + 12 + 8 = 70 Property: Commutative

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LESSON 2
Review Mental Math Strategies

Lesson Overview

In this lesson, students explore a variety of mental math strategies and discuss why it is important to be able to add and subtract mentally. Rounding and estimation have already been explored, so this lesson introduces additional strategies. These strategies are referenced throughout the year as tools to help solve problems mentally and assess the reasonableness of computations. Help students maintain a toolkit of strategies by creating and displaying anchor charts they can reference over time.

Lesson Essential Questions

- Why is it important to be able to add and subtract mentally?
- Which mental math strategies are the most efficient?
- How can estimation help me solve problems accurately?

Learning Objectives

In this lesson

- Students will apply a variety of strategies to add and subtract mentally.
- Students will explain the importance of mental math skills.

Grade-Level Standards

4.C.1.e Assess the reasonableness of answers using mental computation.

Vocabulary Check-In

benchmark numbers, estimate, mental math, round

Materials List

- Mental Math Strategies anchor chart
- Thinking Like a Mathematician anchor chart

Preparation

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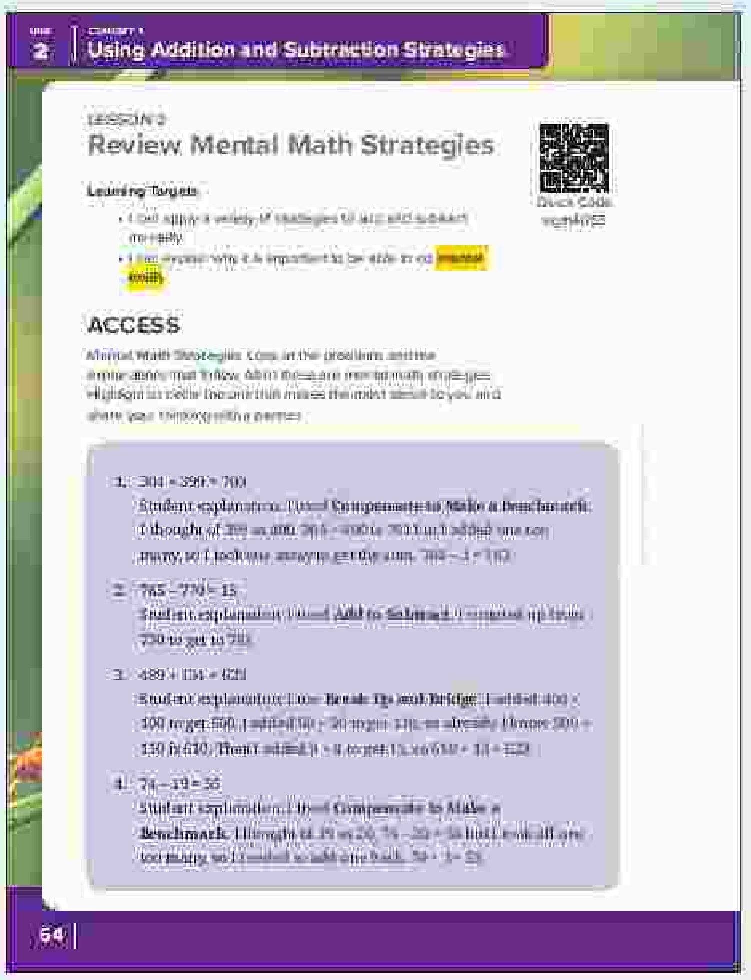


Lesson 2
Review Mental Math Strategies

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- When using compensation to mentally add and subtract, students are often unclear how to balance the amount compensated.

Mental Math Strategies

1. Direct students to their Student Materials and ask them to read the Learning Targets for Lesson 2. Ask students to share with a partner why they think mental math is important.
2. Direct students' attention to Lesson 2 ACCESS Mental Math Strategies. Ask students to read the problems and the explanations of the mental math strategies used by the students in the examples. This can be done chorally, in partners, or independently.
3. Ask students to highlight or circle the strategy that makes the most sense to them and share their thinking with their Shoulder Partner.
4. Explain to students that they will be learning more about each strategy today.

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BUILD (40 min)

TEACHER NOTE: Mental math refers to fact learning, mental computation, and computational estimation. This lesson introduces some common strategies along with estimation and rounding which have already been discussed. These mental math strategies help students think flexibly and are best applied in brief practice sessions over a period of time and introduced with small numbers before applying to larger ones. These strategies will be included periodically in Number Talk experiences throughout Primary 4.

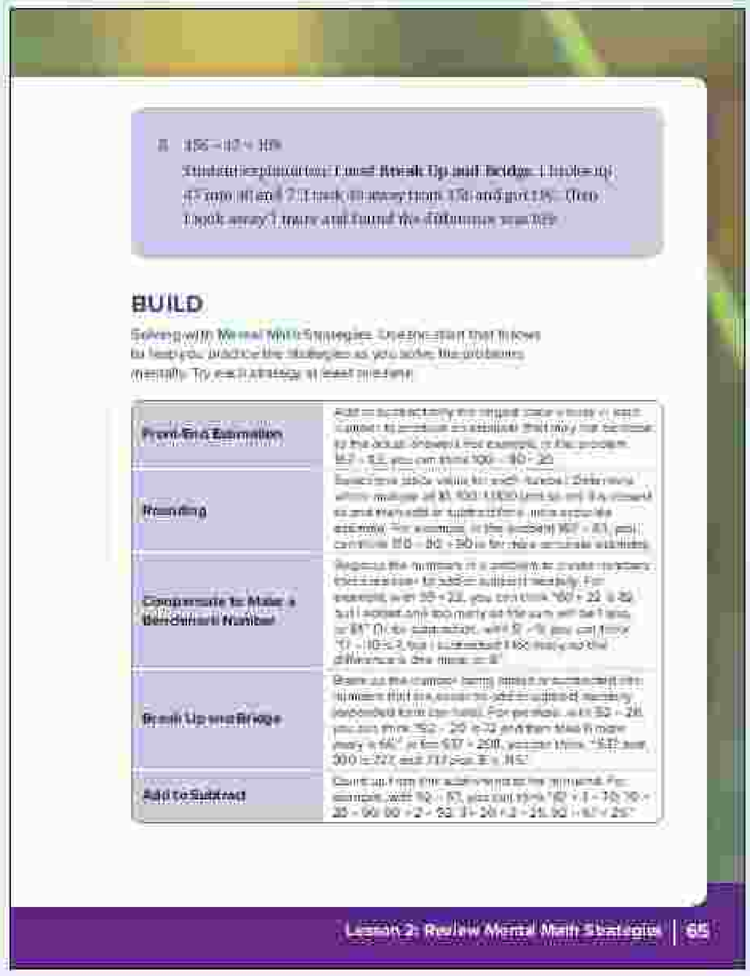
Solving with Mental Math Strategies

1. Display the Mental Math Strategies anchor chart. Direct students to Lesson 2 BUILD Solving with Mental Math Strategies.
2. Remind students that they have already practiced front-end estimation and rounding as mental math strategies, but that these strategies do not provide an exact answer.
3. Model and do a Think Aloud for the strategy **Compensate to Make a Benchmark Number**. A suggested process follows:
   - Review with students the definition of benchmark numbers. Students used benchmark numbers when they studied fractions in Primary 3. Benchmark numbers are "friendly" numbers that are easy to add and subtract mentally and usually include multiples of 10 or 100.
   - Record 37 + 8 on the board. Model as follows compensating by subtracting 3 from the 8 and giving the 3 to the 37 to make a benchmark number (40):

ASK
- Which benchmark number should we make for 37? In other words, what number is 37 close to that is easier to add in our heads? (Most likely students will answer 40. If students have other ideas, let them explain their thinking, but use rounding as a strategy to guide students to choose 40 as the benchmark.)

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ASK
- How many Ones do we need to add to 37 to get to this benchmark?
- Where could I get those 3 Ones?

Do a Think Aloud as you write the following on the board, explaining each step aloud. Be sure to remind students that this strategy makes mental computation much easier.

37 + 8 = _______
   − 3
37 + 5 = _______
40 + 5 = 45

ASK
- What is the new problem we created and what is the sum?

Explain to students that there is sometimes more than one way to compensate in a problem. However, they must maintain balance and make sure the total does not change. In other words, if we take from one number, we have to give to another. If we give to one number, we have to take from another. For example, they could have taken 2 from the 37 to make it 35, adding the 2 to the 8 to make 10. Both strategies work because they maintain balance and provide a correct answer.

ASK
- Do you think we can compensate with subtraction? Why or why not?

Record 36 − 20 = and ask students to solve the problem mentally and tell their Shoulder Partner the difference. Ask volunteers to share their thinking about the following:

ASK
- Knowing that 36 − 20 = 16, what would the answer be if the problem is 36 − 19?
- How do you know?

4. Read the **Break Up and Bridge** strategy as a group. In this strategy, students break up numbers in addition or subtraction problems to get partial answers, and then go back and add or subtract the missing quantities. Model the strategy and do a Think Aloud:
   - Write the problem 32 + 27 = _______ on the board.
   - Explain that you are finding numbers in the problem that are easy to add in your head. For example, 32 + 20 = 52 (write on the board).
   - Then, you simply need to add the remaining 7 from 27. Write on the board: 52 + 7 = 59, so 32 + 27 = 59.

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5. Model and do a Think Aloud for the strategy **Add to Subtract**. In this strategy, students start with the subtrahend and add to get to the minuend. They then find the sum of the numbers they added to the subtrahend.
   - Write the problem 652 – 48 = _______ on the board.
   - Explain that you know you can add 2 to 48 to get to 50, and then add 600 more to get to 650.
   - 652 – 48 = _______

     $$\begin{array}{r} \mathbf{+\ 2} \\ \hline 50 \\ \mathbf{+\ 600} \\ \hline 650 \\ \mathbf{+\ 2} \\ \hline 652 \end{array}$$
   - You added 2, 600, 2 to 48 to make 652. Answer: 652 – 48 = **604**
   - 652 – 48 = _______

     $$\begin{array}{rcl} +\ 2 & \rightarrow & 2 \\ \hline 50 & & \\ +\ 600 & \rightarrow & 600 \\ \hline 650 & & \\ +\ 2 & \rightarrow & 2 \\ \hline 652 & & \end{array}$$

   So, 652 – 48 = **604**

6. Display the Thinking Like a Mathematician anchor chart.

   TEACHER NOTE: Students discussed these traits in Primary 3. This anchor chart represents eight practices that describe the thinking processes, habits of mind, and dispositions that students need to develop a deep, flexible, and enduring understanding of mathematics. The practices are applicable across subject areas and will help students become better learners.

7. Remind students that they had some practice with Thinking Like a Mathematician in Primary 3. They will continue to discuss these ideas to develop a deep and flexible understanding of math. Using mental math strategies is about noticing the structure of numbers (7) to help, as well as using rules and patterns (8).

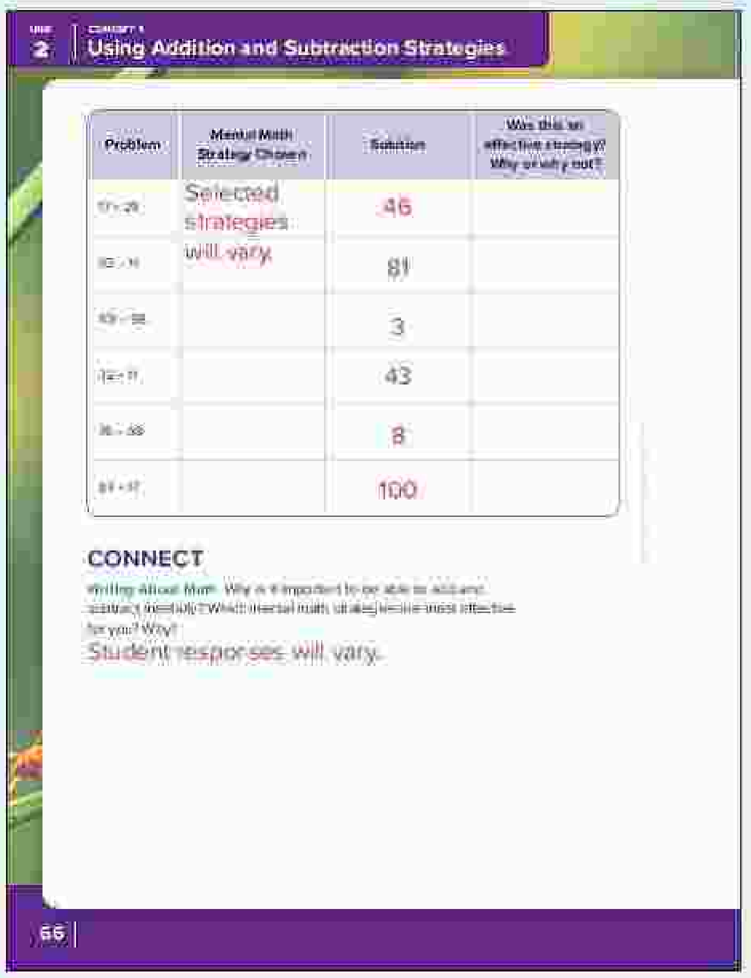
8. Ask students to work with a partner to complete the table in their Student Materials. (If there is not enough time left, ask students to complete the problems for homework. They should be prepared to discuss the strategies they used.) Explain that they might not always use all of the strategies, but good mathematicians use multiple strategies and practices.

9. Review the answers as a class. Remind students that they may have selected different strategies from others. Some mental math strategies are better for some problems, and some mental math strategies are easier to use than others. Allow students to ask questions. Clear up misconceptions as needed.

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2 | Using Addition and Subtraction Strategies

Problem	Mental Math Strategy Chosen	Solution	Was this an effective strategy? Why or why not?
[illegible]	Selected strategies will vary.	46	
[illegible]		81	
[illegible]		3	
[illegible]		43	
[illegible]		8	
[illegible]		100	

CONNECT

Writing About Math Why is it important to be able to add and subtract mentally? Which mental math strategies are most effective for you? Why?

Student responses will vary.

66

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 2 CONNECT Writing About Math and respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Pose the following questions for group discussion. Use Calling Sticks to hear from students.

ASK

- *Which mental math strategies are similar? How?*
- *How could these mental math strategies be combined?*

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions around very large numbers.

Check Your Understanding

Decide which mental math strategy would work best for each problem. There may be more than one best answer.

Compensate to Make a Benchmark	
Break Up and Bridge	Add to Subtract

1. 169 + 32 Compensate to Make a Benchmark
2. 802 – 789 Add to Subtract
3. 64 + 89 Compensate to Make a Benchmark
4. 44 – 23 Break Up and Bridge
5. Solve two of the matching problems using the mental math strategy you selected.

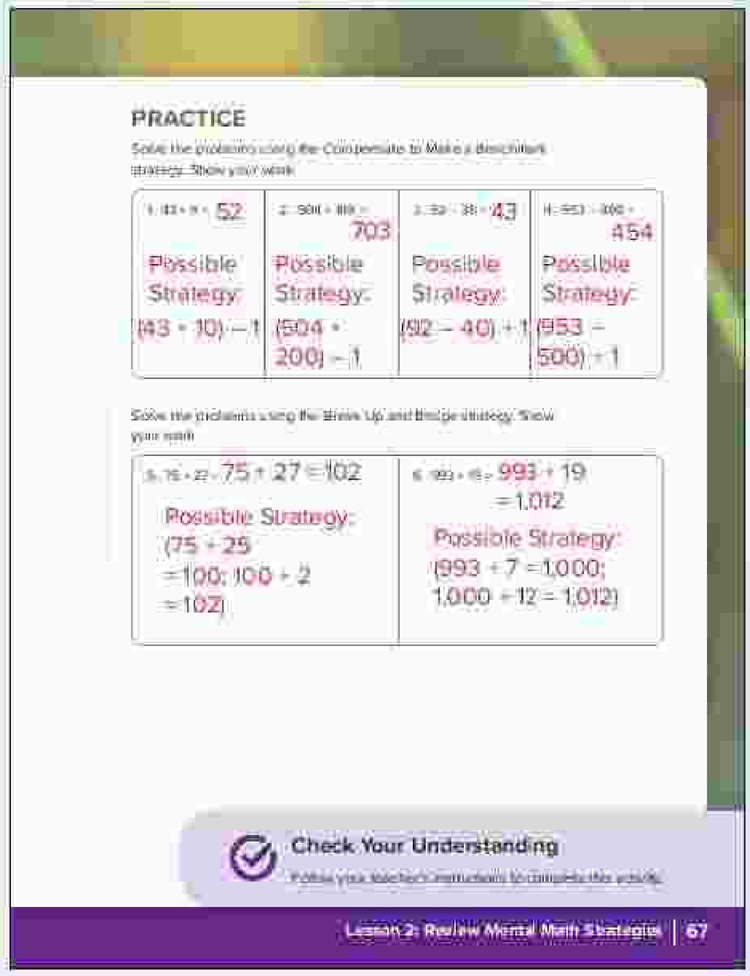
Strategies may vary, but accept all correct applications of strategies. Some possible answers are:

- 169 + 32, (169 + 1) + 32 = 202, so 202 – 1 = 201
- 802 – 789, 789 + 13 = 802, so 802 – 789 = 13
- 64 + 89, 64 + (89 + 1) = 154, so 154 – 1 = 153
- 44 – 23, 40 – 20 = 20 and 4 – 3 = 1, so 44 – 23 = 21

6. Select one of the mental math strategies. Write an addition problem showing how you use that strategy.
   Answers will vary. Accept all correct applications of the strategy.

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PRACTICE

52	703	43	454
Possible Strategy: (43 + 10) – 1	Possible Strategy: (504 + 200) – 1	Possible Strategy: (92 – 40) + 1	Possible Strategy: (953 – 500) + 1

75 + 27 = 102	993 + 19 = 1,012
Possible Strategy: (75 + 25 = 100; 100 + 2 = 102)	Possible Strategy: (993 + 7 = 1,000; 1,000 + 12 = 1,012)

Check Your Understanding

Lesson 2: Review Mental Math Strategies | 67

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LESSON 3
Addition with Regrouping

Materials List

- No additional materials needed

Lesson Overview

In this lesson, students begin with an error analysis problem that reviews the Identity Property and reinforces that it does not apply to subtraction. Students review and practice the standard algorithm for solving addition problems with regrouping. Students should recognize that all of the addition strategies they have learned are available for their use, though they may need additional practice with some of the strategies. Students also use rounding as a form of estimating to check the reasonableness of their answers.

Lesson Essential Questions

- What are the different ways to add?
- Which addition strategies are the most efficient?

Learning Objectives

In this lesson

- Students will add multidigit whole numbers.
- Students will estimate to determine if their answer is reasonable.

Grade-Level Standards

4.A.2.a Fluently add and subtract multidigit whole numbers.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

algorithm

DIGITAL



Lesson 3

Addition with Regrouping

Quick Code: egmt4054

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle with regrouping whether using the standard algorithm or decomposing by place value.
- Students may always start a number line at 0. In problems that use large numbers, it is important to start a number line with numbers other than 0.

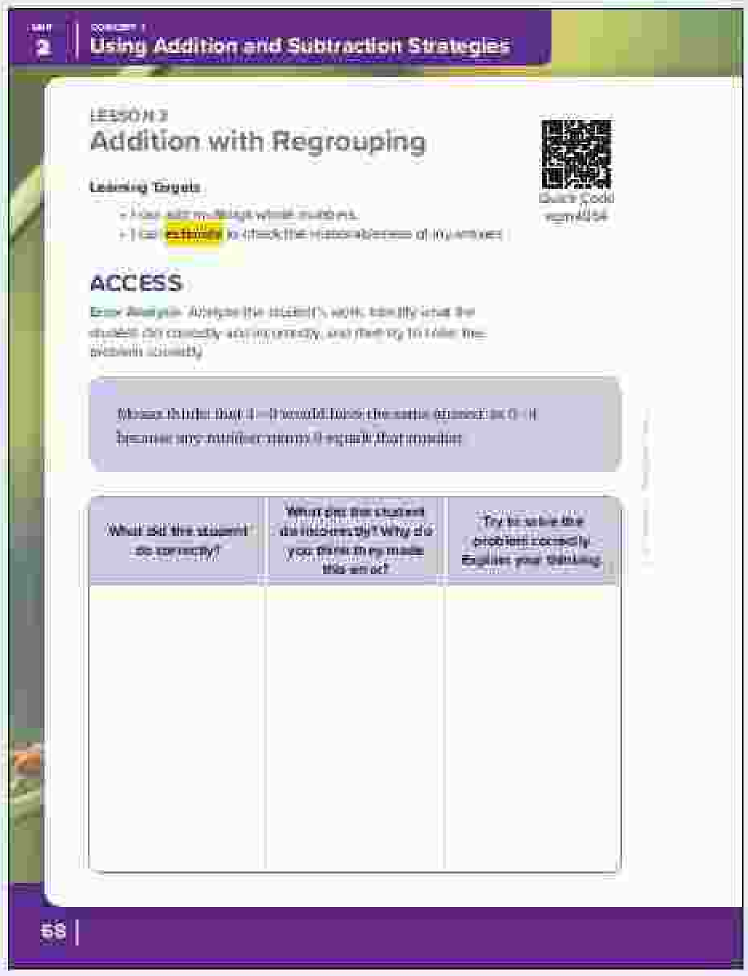
Error Analysis

1. Ask students to open to Lesson 3 ACCESS Error Analysis and complete the error analysis problem.
2. After students are finished, go over the problem as a class.

Answer Key for Error Analysis:
In subtraction, unlike addition, you cannot change the order of numbers and get the same answer. The exception to this would be if the minuend and subtrahend were the same number (as in 5 – 5). Students may also bring up the fact that the student was thinking it would be the same answer because they tried to apply the Additive Identity Property to a subtraction problem.

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UNIT 2 | CONCEPT 1
Using Addition and Subtraction Strategies

LESSON 3
Addition with Regrouping

Learning Targets

ACCESS

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.

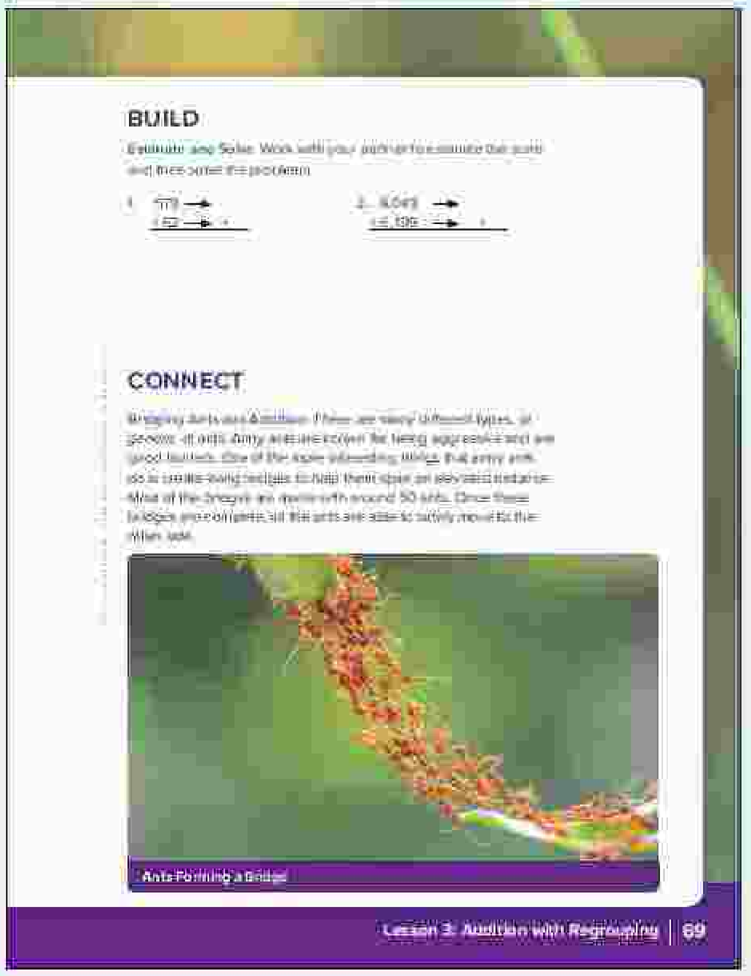
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BUILD

CONNECT

Ants Forming a Bridge

Lesson 3: Addition with Regrouping | 69

BUILD (40 min)

Using the Standard Addition Algorithm (25 min)

1. Explain to students that mental math strategies are helpful, but they also need to know the standard algorithms for solving problems. An algorithm is a procedure or set of steps.
2. Write 466 + 221 vertically on the board. Ask students to help you solve the problem. If students do not remember the steps, remind them they have to start at the Ones place, and ask them to solve 6 plus 1. Record 7. Repeat with the Tens place and the Hundreds place. 687
3. Ask volunteers to summarize in their own words the steps of the standard algorithm for addition.
4. Write 168 + 217 vertically on the board. Again, ask students to help you solve the problem. Ask if any students know what to do when there are 15 Ones in the Ones place. If no students remember regrouping, do the following:
    - Remind students that each place can only hold up to 9.
    - Once there is a number greater than 9 in any place, they must regroup.
    - Ask students if they can make a Ten out of 15. Yes
    - Ask students where Tens belong. Tens place
    - Model how to regroup 15 so 1 Ten is added to the Tens column and 5 Ones are recorded in the Ones place in the answer.
5. Continue to solve the problem with students' help. 385
6. For the remainder of this segment, practice solving additional 2-, 3-, and 4-digit problems together, including problems with no regrouping, problems with one regrouping, and problems with two regroupings. Suggested problems: 56 + 18 (74); 9,107 + 362 (9,469); 724 + 86 (810); and 5,918 + 106 (6,024).

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Estimate and Solve (15 min)

1. Direct students to Lesson 3 BUILD Estimate and Solve. Tell students they have a math superpower that can help them get correct answers every time. Their superpower is rounding. Explain that students can use rounding to estimate sums to see if their answer is reasonable.

2. Write 82 + 16 vertically on the board. Ask students to round 82 to the nearest Ten (80). Then, ask students to round 16 to the nearest Ten (20). Ask students to solve 80 + 20 mentally. Write the following on the board:

$$\begin{array}{r@{\;\rightarrow\;}r} 82 & 80 \\ +16 & +20 \\ \hline & 100 \end{array}$$

3. Explain to students that the estimate is 100, so we know the answer to 82 + 16 should be close to 100. Ask students to help you solve 82 + 16 (98).

4. Tell students that since 98 is close to our estimate, we know our answer is reasonable.

5. Ask students to work with their Shoulder Partner to solve Problem 1 in their Student Materials. After a couple of minutes, go over the solution together.

   TEACHER NOTE: If you find that students rounded in different ways, take a moment to discuss which estimation approach gave the closest estimates. Allow students to share their thinking and draw their own conclusions. Both estimation approaches are valid, but rounding both addends to the nearest Ten gives the estimate closest to the actual sum.

6. Have students work with their partner to solve Problem 2 if time allows. Go over the solution together.

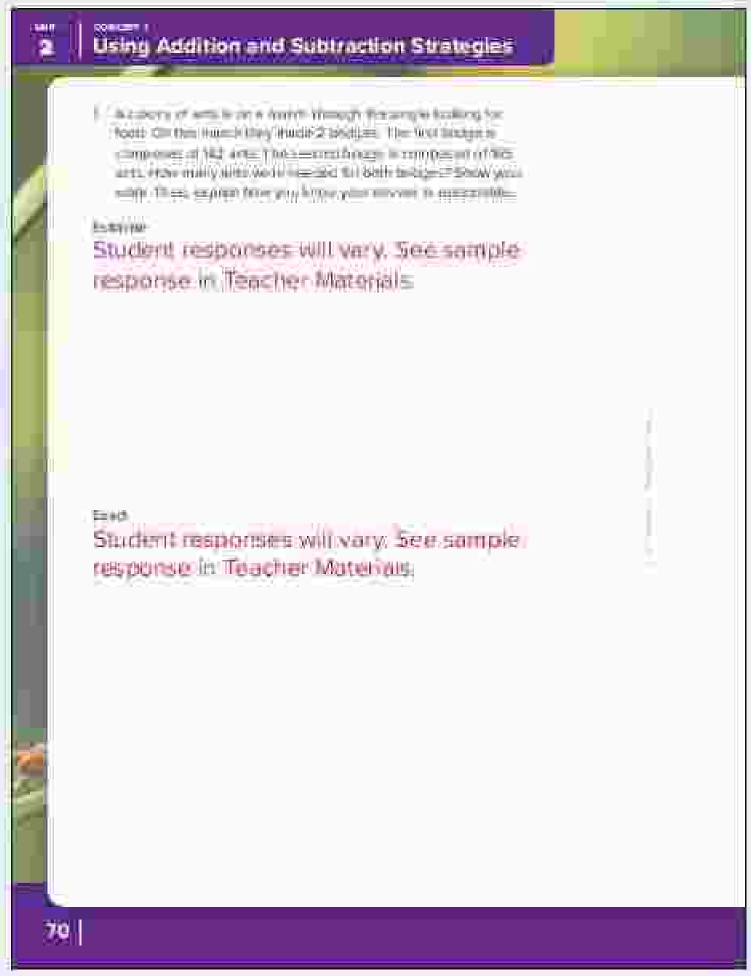
Answer Key for Estimate and Solve:

1. If students rounded both addends to the nearest ten: 640. If students rounded 579 to the nearest hundred and 62 to the nearest ten: 660. Actual sum: 641.

2. If students rounded both addends to the nearest ten: 14,250. If students rounded both addends to the nearest hundred: 14,200. If students rounded both addends to the nearest thousand: 14,000. Actual sum: 14,248.

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2 | Using Addition and Subtraction Strategies

Estimate

Student responses will vary. See sample response in Teacher Materials.

Exact

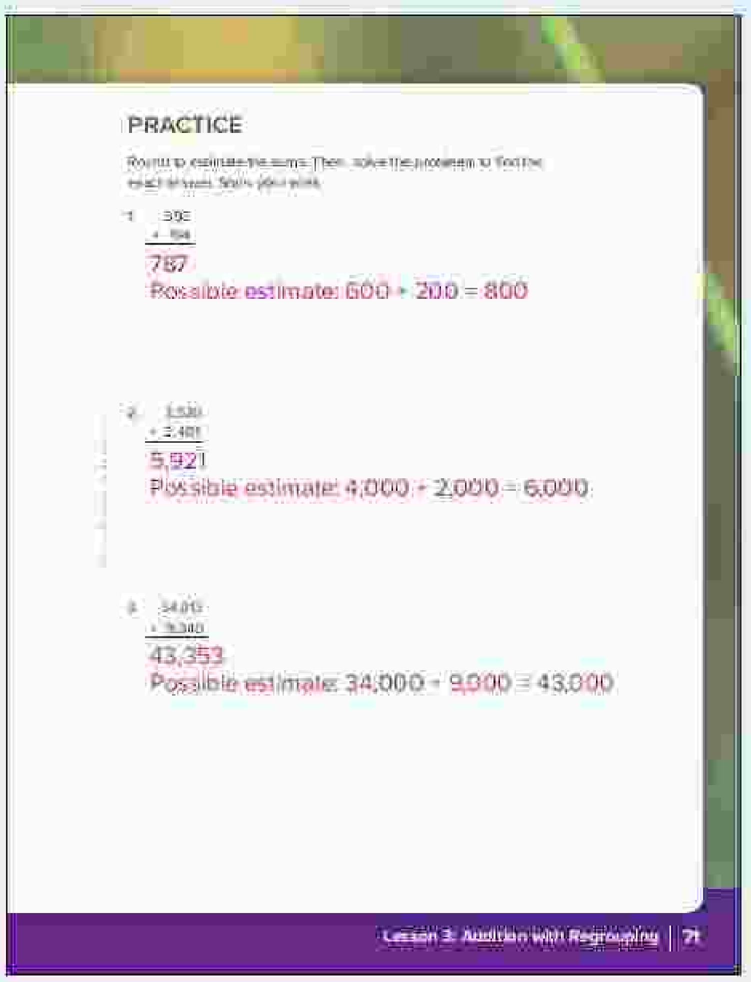
Student responses will vary. See sample response in Teacher Materials.

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PRACTICE

Round to estimate the sums. Then, solve the problems to find the exact answers. Show your work.

1. 787
   Possible estimate: 600 + 200 = 800

2. 5,921
   Possible estimate: 4,000 + 2,000 = 6,000

3. 43,353
   Possible estimate: 34,000 + 9,000 = 43,000

Lesson 3: Addition with Regrouping | 71

CONNECT (7 min)

Bridging Ants and Addition

1. Ask students to turn to Lesson 3 CONNECT Bridging Ants and Addition. Ask volunteers to take turns reading aloud portions of the information about ants.
2. After reading, tell students that scientists are so impressed with the natural algorithm these ants use to create bridges that scientists are studying them to help companies design smarter "robotic swarms" to deliver packages by drones.
3. Ask students to work independently to solve the problem related to ant bridges. Remind students to respond to all parts of the problem.

Answer Key for Bridging Ants and Addition:

1. 142 + 165 = 307. Possible estimates: 100 + 200 = 300; 140 + 170 = 310.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to Turn and Talk to their Shoulder Partner about which strategy they used to solve the problem and why they chose that strategy.
2. After a minute, ask students to share their thinking with the class.

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PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Complete the chart below:

Ant Species Totals			
	Species	Total	Round Each Number to the Nearest Thousand
1	Black Garden Ants	58,712	59,000
2	Pavement Ants	81,475	81,000
3	Pharaoh Ants	42,358	42,000

4. How many ants would you have if you combined the pharaoh ants and the pavement ants? Use your rounded numbers from the table to estimate, and then find the exact answer.

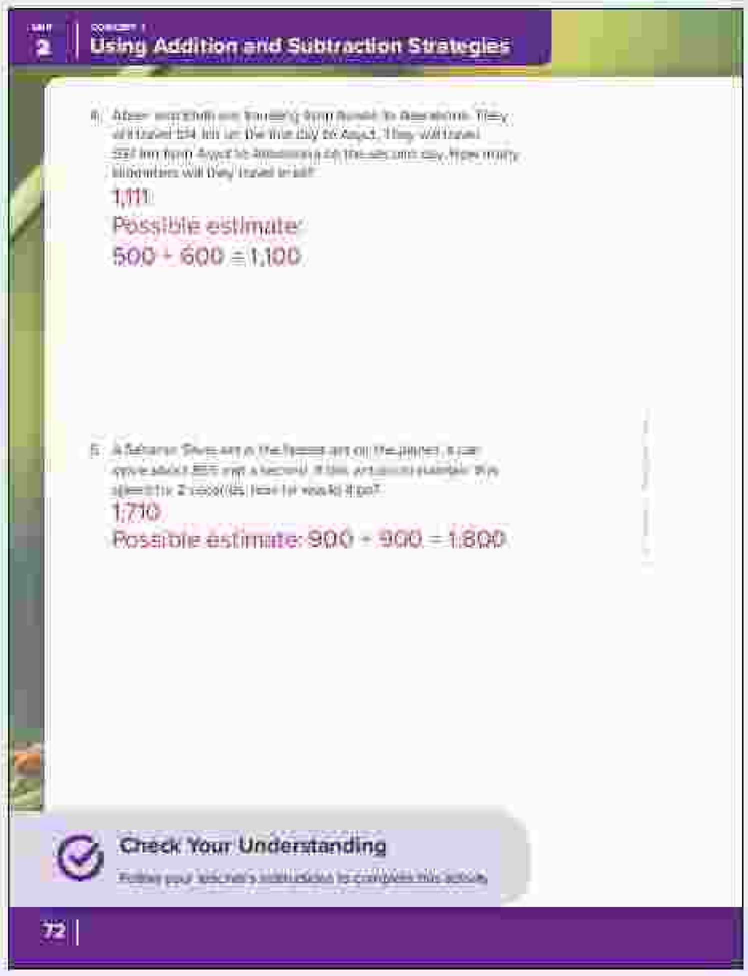
$$\begin{array}{rcr} 42{,}000 & \rightarrow & 42{,}358 \\ +81{,}000 & \rightarrow & +\ 81{,}475 \\ \hline 123{,}000 & & 123{,}833 \end{array}$$

5. What is the total amount of ants? Use your rounded numbers from the table to estimate, and then find the exact answer.

$$\begin{array}{rcr} 59{,}000 & \rightarrow & 58{,}712 \\ 81{,}000 & \rightarrow & 81{,}475 \\ +42{,}000 & \rightarrow & +\ 42{,}358 \\ \hline 182{,}000 & & 182{,}545 \end{array}$$

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UNIT 2 | CONCEPT 1
Using Addition and Subtraction Strategies

4\.

1,111
Possible estimate:
500 + 600 = 1,100

5\.

1,710
Possible estimate: 900 + 900 = 1,800

Check Your Understanding

72



Materials List

- Mental Math Strategies anchor chart
- Thinking Like a Mathematician anchor chart

Preparation

- Prior to the lesson, add the strategies Counting Back with Decomposition and Counting Up with Decomposition to the Mental Math Strategies anchor chart.

DIGITAL



Lesson 4

Subtraction Strategies

Quick Code: egmt4055

LESSON 4
Subtraction Strategies

Lesson Overview

In this lesson, students begin with a Number Talk to help them mentally solve addition problems. Number Talks require students to think deeply about problems without pencil or paper in order to better develop their number sense and flexibility with solving problems mathematically. Students then use decomposition of numbers to subtract.

Lesson Essential Questions

- What are the different ways to subtract?
- Which subtraction strategies are the most efficient?

Learning Objectives

In this lesson

- Students will use decomposition of numbers to subtract multidigit whole numbers.
- Students will explain the importance of finding patterns and relationships in mathematics.

Grade-Level Standards

4.2.A.a Fluently add and subtract multidigit whole numbers.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

difference, minuend, subtrahend

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle with decomposing numbers in meaningful ways (ways that make sense to them).
- Students may struggle with where to place numbers on an open number line.

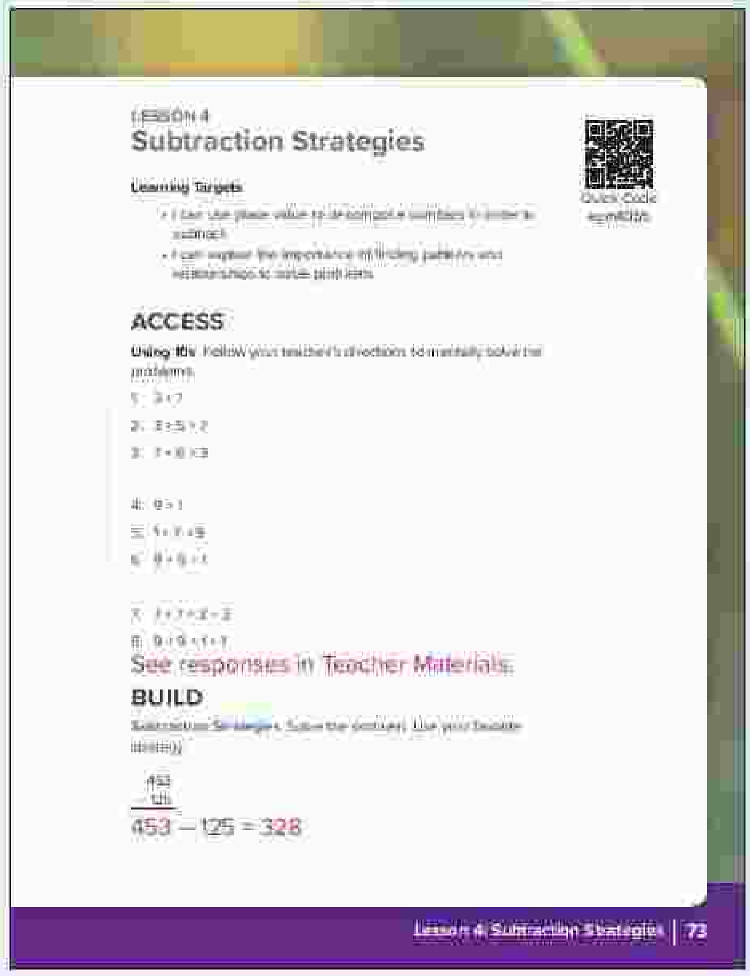
Using 10s

TEACHER NOTE: If individual white boards are available, students can write their answers on them and hold them up to show their responses rather than giving a Thumbs Up. This strategy allows all students to respond and for you to see quickly who is struggling. The computation strategy of finding combinations of tens is best learned with small numbers so that students can solve them mentally. This will aid them later when using larger numbers.

1. Explain to students that using 10s facts is a helpful strategy to use with addition problems. Introduce the Number Talk by explaining to students that they will look at some addition problems. When you give the signal, they should try to solve them mentally using 10s as a benchmark, or friendly, number.
2. Have students turn to Lesson 4 ACCESS Using 10s.
3. Direct students to solve Problems 1–3 mentally and give a Thumbs Up when they know the answers. Give students about 30 seconds to solve the problems.
4. Call on several students who have their thumbs up and record their answers on the board. Ask students to explain how they used 10s to solve the problems. Record students' thinking on the board and encourage students to ask each other questions.
5. Repeat the process with Problems 4–6 and then 7–8.
6. Ask students to discuss how they could use 100s in the same way to make mental addition easier.

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LESSON 4
Subtraction Strategies

Learning Targets

ACCESS

See responses in Teacher Materials.

BUILD

453 − 125 = 328

Lesson 4: Subtraction Strategies | 73

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Answer Key for Using 10s:

1. 10
2. 15 (7 + 3 = 10, 10 + 5 = 15)
3. 16 (7 + 3 = 10, 10 + 6 = 16 or +1 from the previous problem)
4. 10
5. 17 (9 + 1 = 10, 10 + 7 = 17)
6. 16 (9 + 1 = 10, 10 + 6 = 16 or -1 from the previous problem)
7. 20 (7 + 3 = 10, 10 + 10 = 20 or 10 × 2 = 20)
8. 20 (9 + 1 = 10, 10 + 10 = 20 or 10 × 2 = 20)

BUILD (40 min)

Subtraction Strategies (20 min)

1. Ask students to chorally read today's Learning Targets.
2. Ask students to turn to Lesson 4 BUILD Subtraction Strategies and solve Problem 1 using the subtraction strategy they prefer.

Answer Key for Subtraction Strategies:

1. 328

TEACHER NOTE: This problem can serve as a formative assessment. Notice what strategies students use. Select a few students with different strategies to share. If no student uses the strategies below (counting back with decomposition of the subtrahend or counting up with decomposition of the minuend), model them for students. A suggested procedure is shared.

3. Ask a few students to share their subtraction strategies with the class. Record students' thinking on the board. Display the Mental Math Strategies anchor chart (if it is not already displayed) and add any new strategies students describe to the anchor chart.
4. Model **Counting Back with Decomposition** and **Counting Up with Decomposition** and add them to the Mental Math Strategies anchor chart.

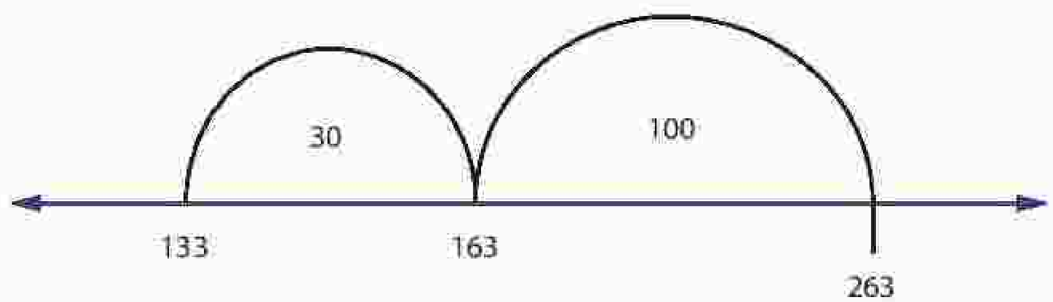
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Counting Back with Decomposition

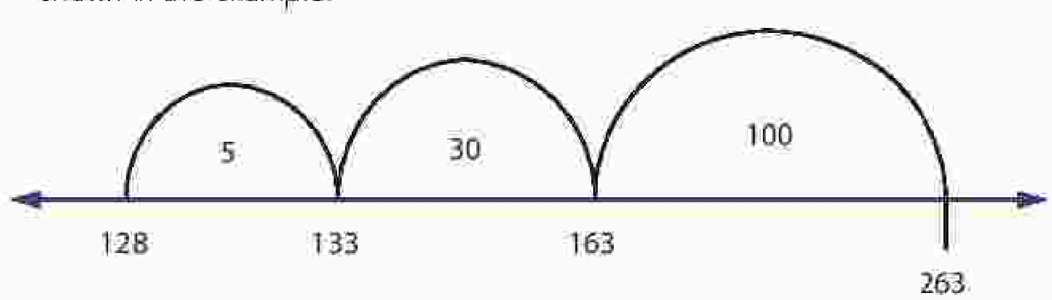
- Write 263 – 135 = _______ on the board.
- Draw an open number line. Write the minuend (larger number in a subtraction problem) at the right end of the number line.

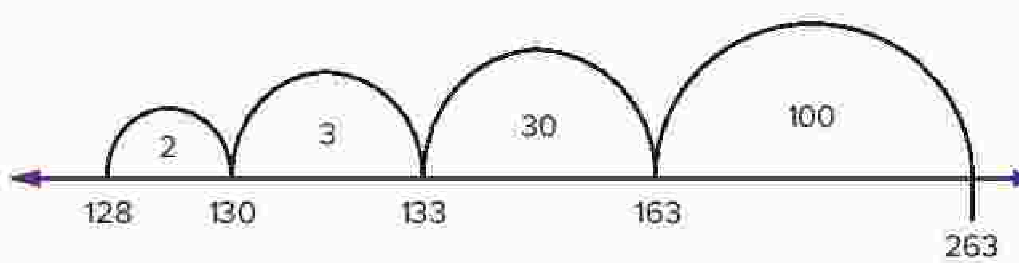


- Do a Think Aloud as you break the subtrahend (smaller number in a subtraction problem) into expanded form. 100 + 30 + 5
- Model how to move backwards on the number line using the numbers from the expanded form of 135. The example shows the numbers from the decomposed subtrahend above the number line. The differences are recorded below the number line.



- At this point in the problem, you can either model subtracting the 5, or you can make it even simpler by decomposing the 5 into a 3 and 2. The two options are shown in the example.





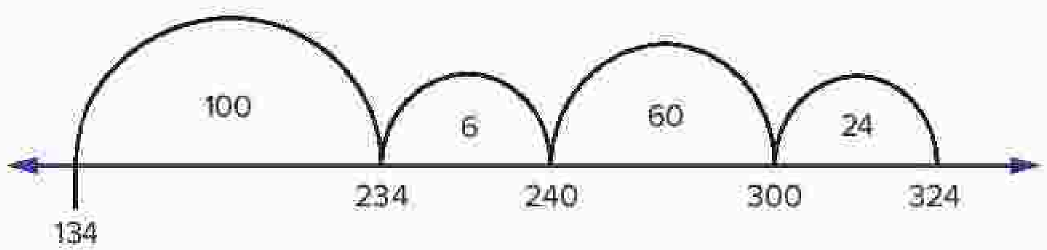
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Counting Up with Decomposition

- Write 324 – 134 = _______ on the board.
- Draw a number line and write the subtrahend on the far left of the number line.



- Do a Think Aloud as you count up to make the minuend, recording your jumps above the number line and the sums below the number line. An example is shown.



- Explain to students that they can count up with any combination of numbers ("jumps") as long as they reach the minuend. They should use numbers that are friendly to them.
- Model how to add the numbers above the number line to find the difference between 324 and 134. 190

Exploring Subtraction Strategies (20 min)

1. Ask students to turn to Lesson 4 BUILD Exploring Subtraction Strategies and work with a partner to solve Problems 1–4. Explain that they might not always use all of the strategies on the anchor chart, but good mathematicians use multiple strategies and practices.
2. After 12–15 minutes, review the answers as a class. Ask students to share their thinking about the strategies they used and allow them to ask questions. Clear up misconceptions as needed.

Answer Key for Exploring Subtraction Strategies:

1. 136
2. 2,298
3. 460
4. 49

CONNECT (7 min)

Writing About Math

1. Direct students to Lesson 4 CONNECT Writing About Math and read the prompt aloud.
2. Give students 5–6 minutes to respond to the questions.

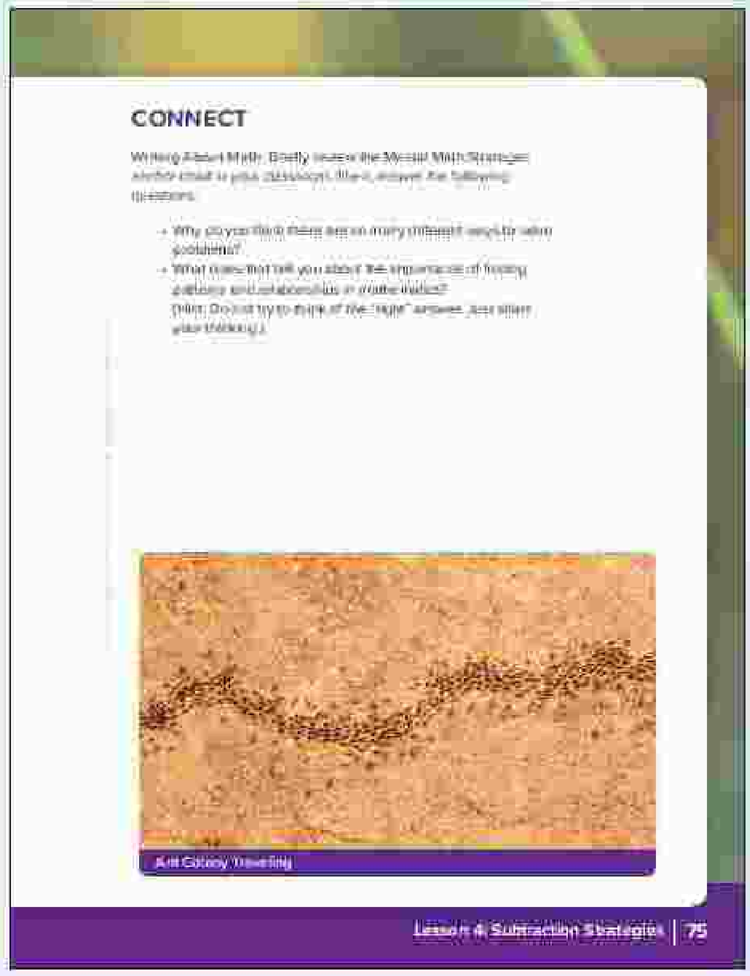
WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask volunteers to share their Writing About Math responses. Encourage students to ask each other questions.

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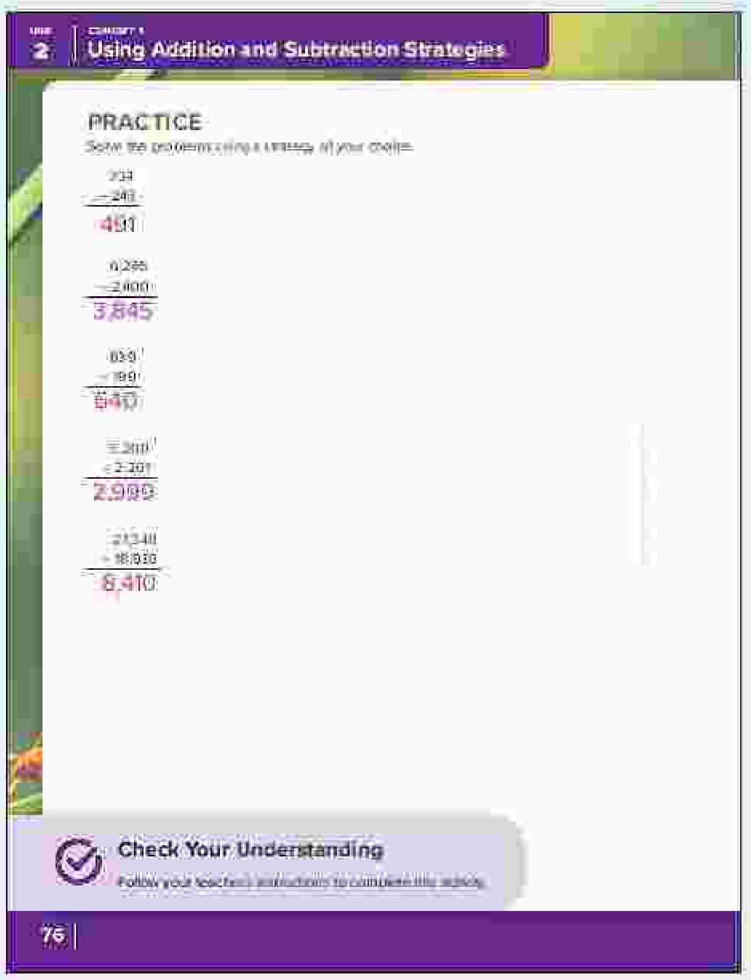
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2 Using Addition and Subtraction Strategies

PRACTICE

Solve the problems using a strategy of your choice.

491

3,845

640

2,999

8,410

Check Your Understanding

Follow your teacher's instructions to complete this activity.

76

PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve the problems using a strategy of your choice.

1. 8,497 – 1,246 = 7,251
2. 1,325 – 920 = 405
3. 310 – 106 = 204
4. 10,000 – 350 = 9,650
5. 766 – 564 = 202

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Mental Math Strategies

Add these strategies to the Mental Math Strategies anchor chart.

Counting Back with Decomposition	**Draw an open number line and write the minuend at the right end of the line. Decompose the subtrahend into expanded form. Count back from the minuend using the expanded form of the subtrahend.** For example, with 312 – 116, you can write 312 at the right end of a number line, and then break 116 into 100 + 10 + 6. Count back on the number line using the expanded form: 312 – **100** = 212; 212 – **10** = 202; 202 – **6** = 196. So, 312 – 116 = 196.
Counting Up with Decomposition	**Draw an open number line and write the subtrahend at the left end of the line. Decompose the minuend into friendly numbers or using expanded form. Count up from the subtrahend to the minuend, recording the jumps and the new sums. Add the jumps together to find the difference.** For example, with 312– 116, you can write 116 at the left end of a number line, and then make "friendly" jumps to get to 312: 116 + **100** = 216; 216 + **4** = 220; 220 + **80** = 300; 300 + **12** = 312. 100 + 4 + 80 + 12 = 196. So, 312 – 116 = 196.

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Materials List

- Place value chart showing Thousands and Ones periods
- Subtraction strategy signs

Preparation

Draw a place value chart on the board showing Thousands and Ones periods. In large writing, label four sheets of paper with a subtraction strategy:

- Standard Subtraction Algorithm
- Counting Up with Decomposition
- Counting Down with Decomposition
- Other Strategy

DIGITAL



Lesson 5

Subtraction with Regrouping

Quick Code: egmt4056

LESSON 5
Subtraction with Regrouping

Lesson Overview

In this lesson, students review and practice the standard algorithm for subtraction, drawing place value representations to help support the decomposition of each place into smaller units.

Lesson Essential Questions

- What are the different ways to subtract?
- Which strategies are the most efficient?

Learning Objectives

In this lesson

- Students will use place value to subtract using the standard algorithm.
- Students will subtract with regrouping.
- Students will estimate to check the reasonableness of their answers.

Grade-Level Standards

4.A.2.a Fluently add and subtract multi-digit whole numbers.

Vocabulary Check-In

algorithm, regroup

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students struggle to understand the standard algorithm for subtraction when regrouping is required. They do not decompose into smaller units to solve.
- Students tend to model both the subtrahend and minuend instead of recognizing that the minuend is the only number to model since the subtrahend will be taken away from that larger number.

Error Analysis

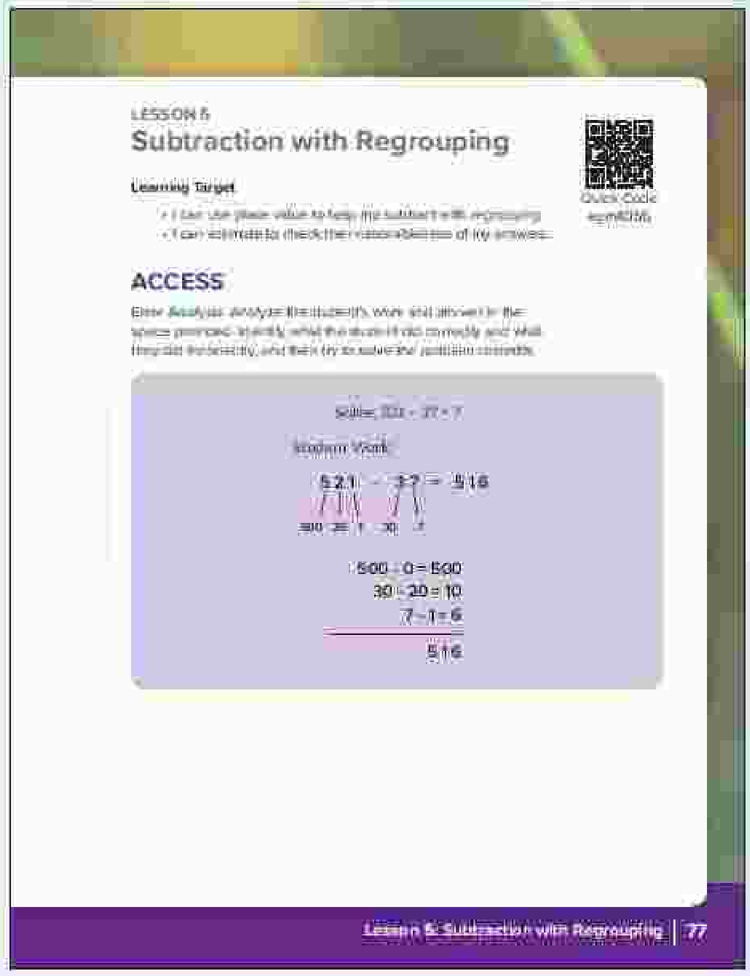
1. Ask students to turn to Lesson 5 ACCESS Error Analysis and complete the error analysis.
2. Go over the answers as a class.

Answer Key for Error Analysis:

Students should be able to explain that, although the student did decompose the numbers correctly, they then subtracted incorrectly. The student tried to subtract the minuend (the top, or larger, number) from the subtrahend (the bottom, or smaller, number). Students may also recognize that the student needed to regroup to solve the problem. Students may also note that the answer does not make sense, since 516 is only 5 less than 521.

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LESSON 5

Subtraction with Regrouping

Learning Target

ACCESS

521 – 37 = 516

500 – 0 = 500

30 – 20 = 10

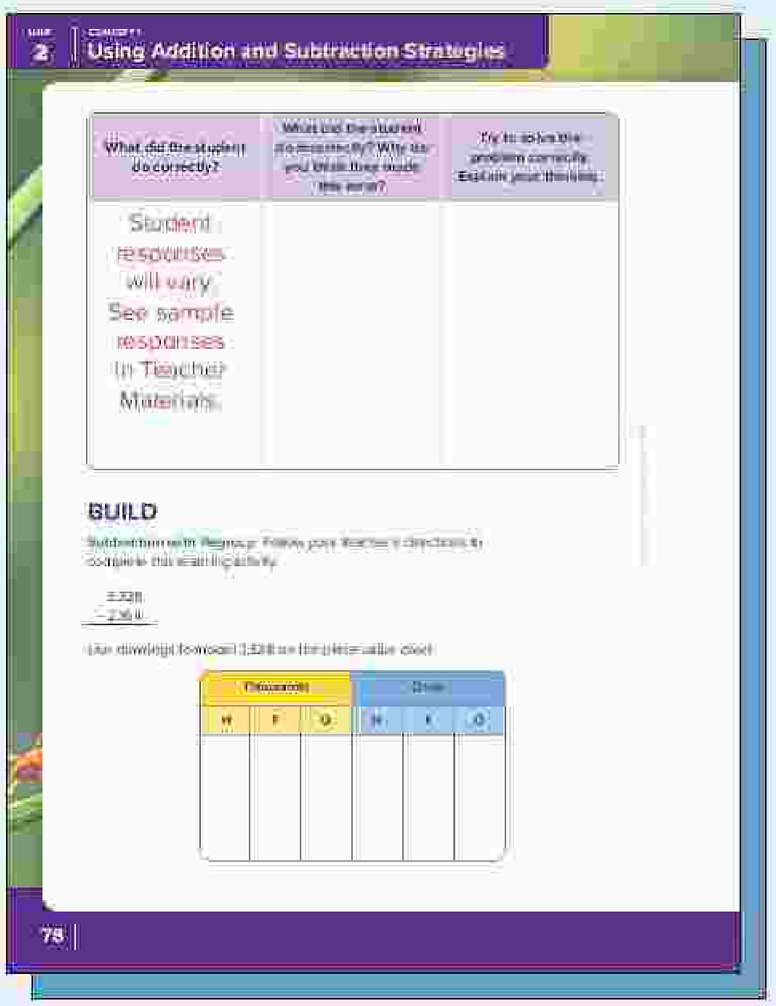
7 – 1 = 6

516

Lesson 5: Subtraction with Regrouping | 77

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Unit 2 | Using Addition and Subtraction Strategies

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.
Student responses will vary. See sample responses in Teacher Materials.		

BUILD

3,328
− 2,164

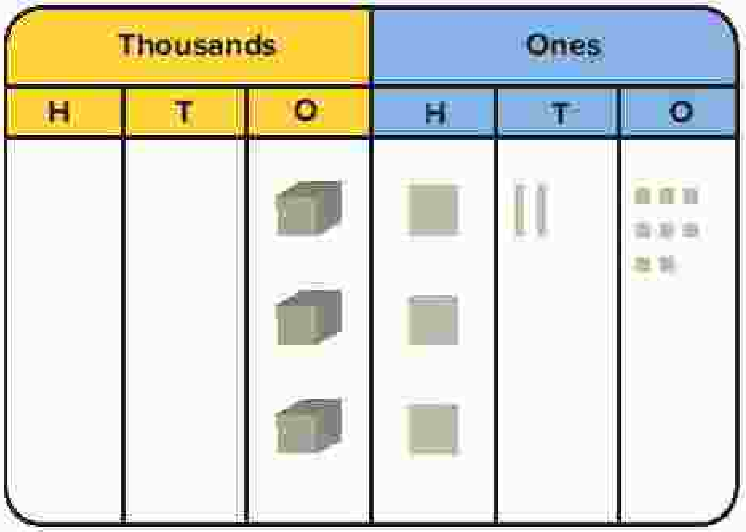
Thousands			Ones		
H	T	O	H	T	O

78

BUILD (40 min)

Subtraction with Regrouping (15 min)

1. Ask students to turn to Lesson 5 BUILD Subtraction with Regrouping. Ask students to use the place value chart in their books to model the number 3,328 using images for Ones, Tens, Hundreds, and Thousands to represent the number in each place. An example is shown. As students are working, draw a model on the board where all students can see it.



2. Ask students to explain why they would only need to model the minuend and not the subtrahend. Students should state that since the subtrahend is being taken away it does not need to be drawn. It would only need to be shown in an addition problem.

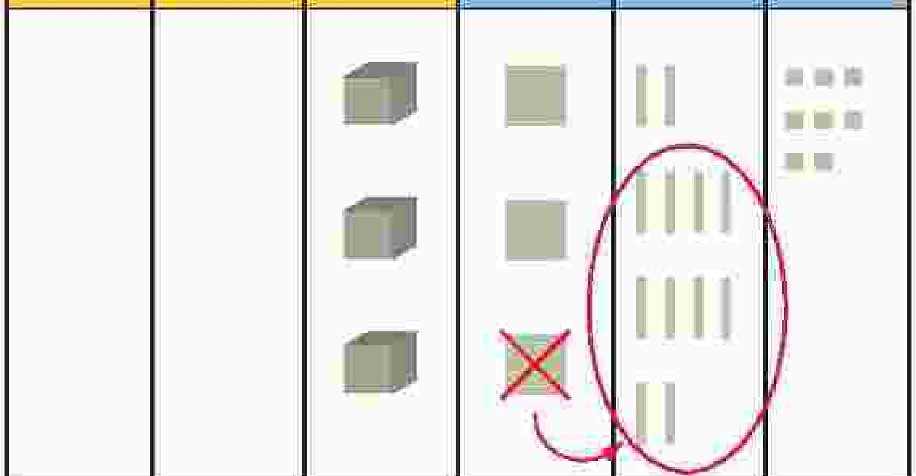
3. Use your model to review the process for using the standard subtraction algorithm with regrouping, asking students to provide the steps whenever possible. Ask questions to help guide students' thinking. Sample questions are given.

    - Look at the model for 3,328. We want to subtract 2,164 from 3,328. Are there any places values where we will need to regroup? Tens place
    - Do we have enough Ones? Yes. Tens? No. Hundreds? Yes. Thousands? Yes

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- Is there a place where we need to "take away" more than we have available? Tens place

Thousands			Ones		
H	T	O	H	T	O
		2	1	6	4
		1	1	6	4

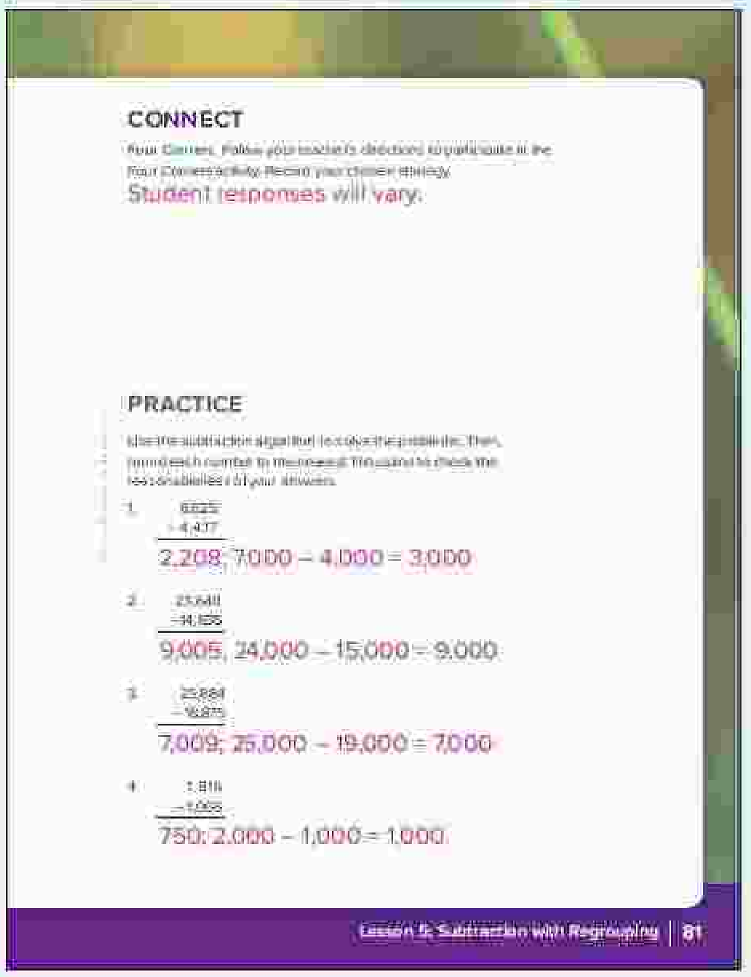


Ant Facts and Algorithms (25 min)

1. Ask students to turn to Lesson 5 BUILD Ant Facts and Algorithms. Ask volunteers to read the paragraphs aloud.
2. Ask a volunteer to read Problem 1 aloud, and then direct students to record an equation for the story.
3. Ask for a volunteer to write the equation on the board (vertically) while students check to make sure they have written the correct equation.
4. Ask the volunteer to first estimate the difference by rounding each number to the nearest Thousand. The student should record the problem and estimate on the board. Ask students to check their estimates and make corrections, if necessary.
5. Finally, have the volunteer return to their seat and ask all students to solve the problem independently using the standard algorithm, and recording their answer in the Student Materials.
6. When students are finished solving Problem 1, ask a volunteer to solve it at the board, modeling subtraction with regrouping and the standard subtraction algorithm. Seated students should check their work and correct any errors.
7. Model how to compare the estimated answer to the actual answer to check the reasonableness of the final difference.
8. Repeat the process for the Problems 2 and 3.

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CONNECT

Four Corners: Follow your teacher's directions to participate in the Four Corners activity. Record your chosen strategy.

Student responses will vary.

PRACTICE

Use the subtraction algorithm to solve the problems. Then, round each number to the nearest thousand to check the reasonableness of your answers.

1. 6,625 − 4,417
   2,208; 7,000 − 4,000 = 3,000
2. 23,640 − 14,635
   9,005; 24,000 − 15,000 = 9,000
3. 25,884 − 18,875
   7,009; 25,000 − 19,000 = 7,000
4. 1,818 − 1,068
   750; 2,000 − 1,000 = 1,000

Lesson 5: Subtraction with Regrouping | 81

Answer Key for Ant Facts and Algorithms:

1. 4,000 – 2,000 = 2,000; 3,548 – 1,672 = 1,876
2. 3,000 – 1,000 = 2,000; 3,452 – 1,267 = 2,185
3. 255,000 – 6,000 = 249,000; 255,000 – 6,200 = 248,800

CONNECT (7 min)

Four Corners

1. Place signs listing the following strategies around the room:
   - Standard Subtraction Algorithm
   - Counting Down with Decomposition
   - Counting Up with Decomposition
   - Other Strategy
2. Ask students to stand by the strategy that they prefer to use when subtracting. Emphasize that there are multiple ways to subtract, so any students who do not prefer one of the practiced strategies should stand by the card that says Other Strategy.
3. Ask students to share in their corner groups why this is their preferred strategy.
4. Ask students to return to their seats and turn to Lesson 5 CONNECT Four Corners to record their preferred strategy.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask a few volunteers to share their thinking with the whole group.
2. Ask students to discuss why they think they are learning so many addition and subtraction strategies.
   Accept all reasonable responses, but emphasize those that place importance on building understanding of patterns and relationships in mathematics and creating a tool kit of problem-solving strategies.

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PRACTICE

Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Use the standard subtraction algorithm to solve the problem. Then, round each number to the nearest Thousand to check the reasonableness of your answers.

   13,526 – 2,834 = 10,692; 14,000 – 3,000 = 11,000

2. Use the standard subtraction algorithm to solve the story problem. Record your equation and show your thinking. Then, round each number to the nearest Hundred to check the reasonableness of your answer.

   A local bakery sold 1,232 zalabya in one day. If they sold 876 zalabya in the morning, how many were sold during the rest of the day?

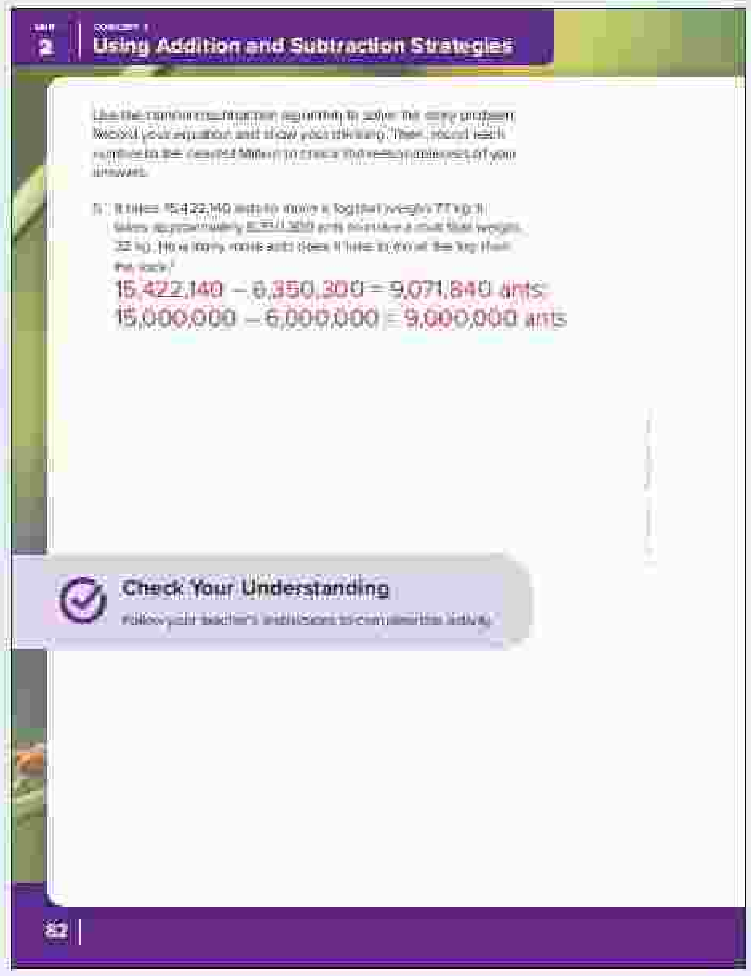
   1,232 – 876 = 356 zalabya; 1,200 – 900 = 300 zalabya

Solve the following problems using the standard subtraction algorithm. Then, round each number to the nearest Thousand to check the reasonableness of your answers. You may draw a place value chart to organize the problems, if needed.

3. 17,525 – 13,708 = 3817; 18,000 – 14,000 = 4,000
4. 431,925 – 204,835 = 227,090; 432,000 – 205,000 = 227,000
5. 61,851 – 52,670 = 9,181; 62,000 – 53,000 = 9,000

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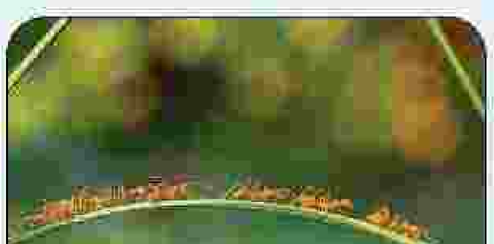


Materials List

- Materials may vary

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DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4057

Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Using Addition and Subtraction Strategies. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- Do the properties of addition apply to subtraction? Why or why not?
- Why is it important to be able to add and subtract mentally?
- How can estimation help to solve problems accurately?
- Which addition strategies are the most efficient?
- Which subtraction strategies are the most efficient?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to using addition and subtraction strategies.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.A.2.a Fluently add and subtract multi-digit whole numbers.

4.C.1.d Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation.

Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- Students may not understand that, although the order of numbers does not matter in an addition problem, it matters greatly and changes the answer with a subtraction problem.
- Students may struggle to remember the difference between the Associative and Commutative Properties.
- When using compensation to mentally add and subtract, students are often unclear how to balance the amount compensated.
- Students may struggle with regrouping whether using the standard algorithm or decomposing by place value.
- Students may struggle with decomposing numbers in meaningful ways (ways that make mental math easier).

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Remediation: Correcting Misconceptions

If...	Then...
Students do not understand that the order of numbers does not matter in an addition problem, but it does matter greatly and changes the answer with a subtraction problem.	Review Do the Properties Apply? from Lesson 1. Consider having students "test" the properties using manipulatives and small numbers. Ask students to discuss their findings when they change the order of the numbers (and manipulatives) in the problems.
If...	**Then...**
Students are struggling to fluently add or subtract multidigit numbers.	Review Lessons 3 and 4. Consider having students use place value charts to help organize their problems and visualize what they are doing when they add and subtract using the standard algorithms. If possible, have students work with a partner who is fluent so the partner can offer support and guidance.
If...	**Then...**
Students struggle to understand the standard algorithm for subtraction when regrouping is required. They do not decompose into smaller units to solve.	Review Subtraction with Regrouping from Lesson 5. Consider helping students practice 3- and 4-digit addition and subtraction using base ten blocks. Model for students how to regroup by exchanging a hundred for 10 Tens or a Ten for 10 Ones. For some students, physically regrouping the manipulatives can help them visualize what is happening when they use the standard algorithm. If possible, have students work with a partner who is fluent so the partner can offer support and guidance.

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Remediation: Correcting Misconceptions

If...	Then...
Students struggle to understand how compensation works and do not remove or add the appropriate amount to find the actual answer.	Practice Compensation using beans to concretely model the strategies. 1. Hand out cups of beans or counters (one cup per two students with 60–70 beans, if possible). 2. Model **Looking for Compatibles** (using the beans). • Pose the following problem 37 + 8 = ______. • Students make a pile of 37 beans and a pile of 8 beans. Ask them to move 3 beans from the 8 to the 37 making 40 and then students can see that the sum is 45. • Repeat with another problem using small numbers and stressing that making a Benchmark 10 or 100 or a 1,000 is helpful when mentally adding because they are using a Benchmark number that is easy to add mentally. 3. Model **Compensation for Addition and Subtraction** using the beans. • **Addition**: Ask students to make a pile of 29 beans and a pile of 15. Ask students to whisper the sum. ASK • What is the sum of 30 and 15? (Have students try to solve mentally.) • How is this problem similar to 29 + 15? • How can solving 30 + 15 help us solve 29 + 15?

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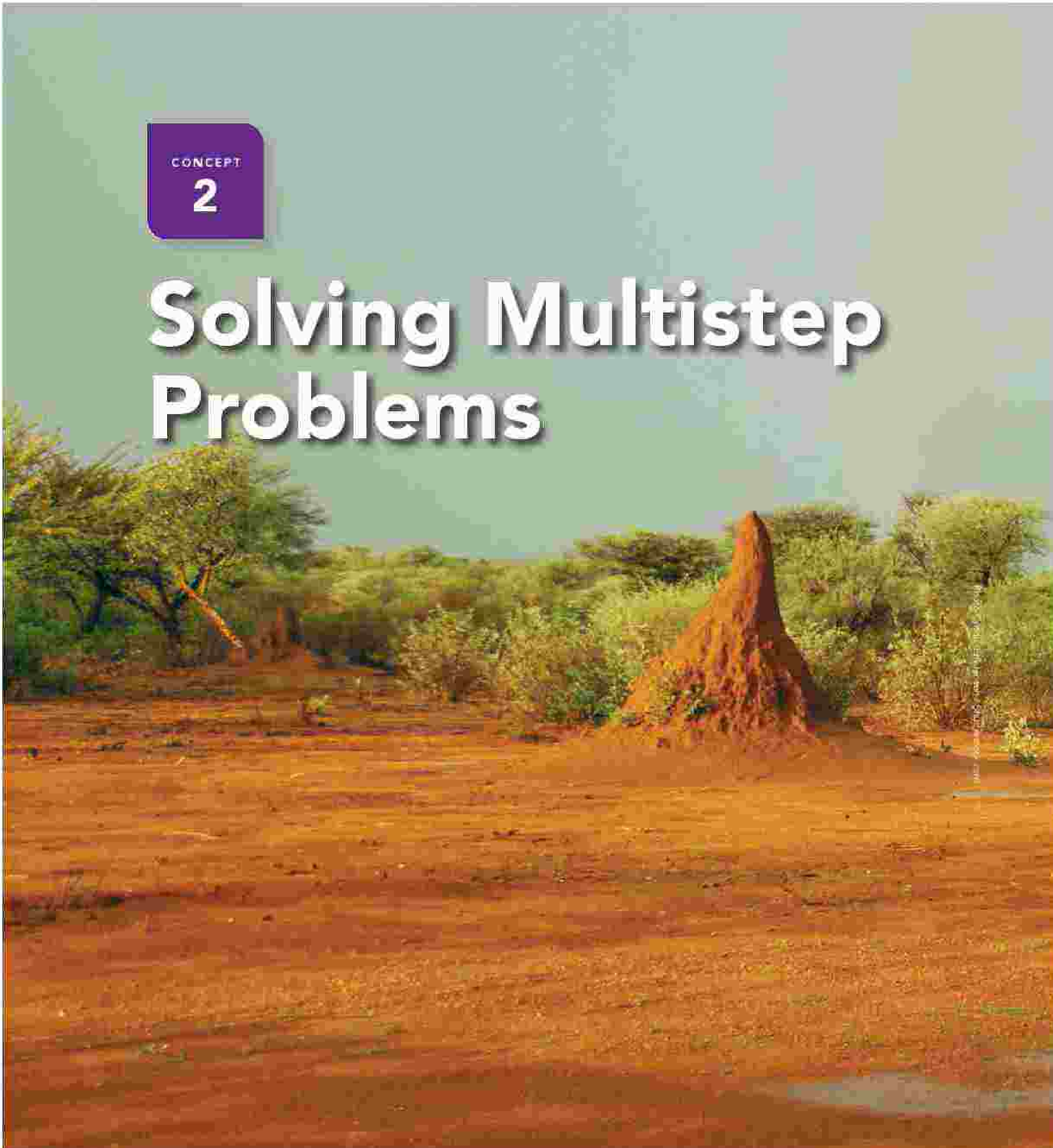
Remediation: Correcting Misconceptions

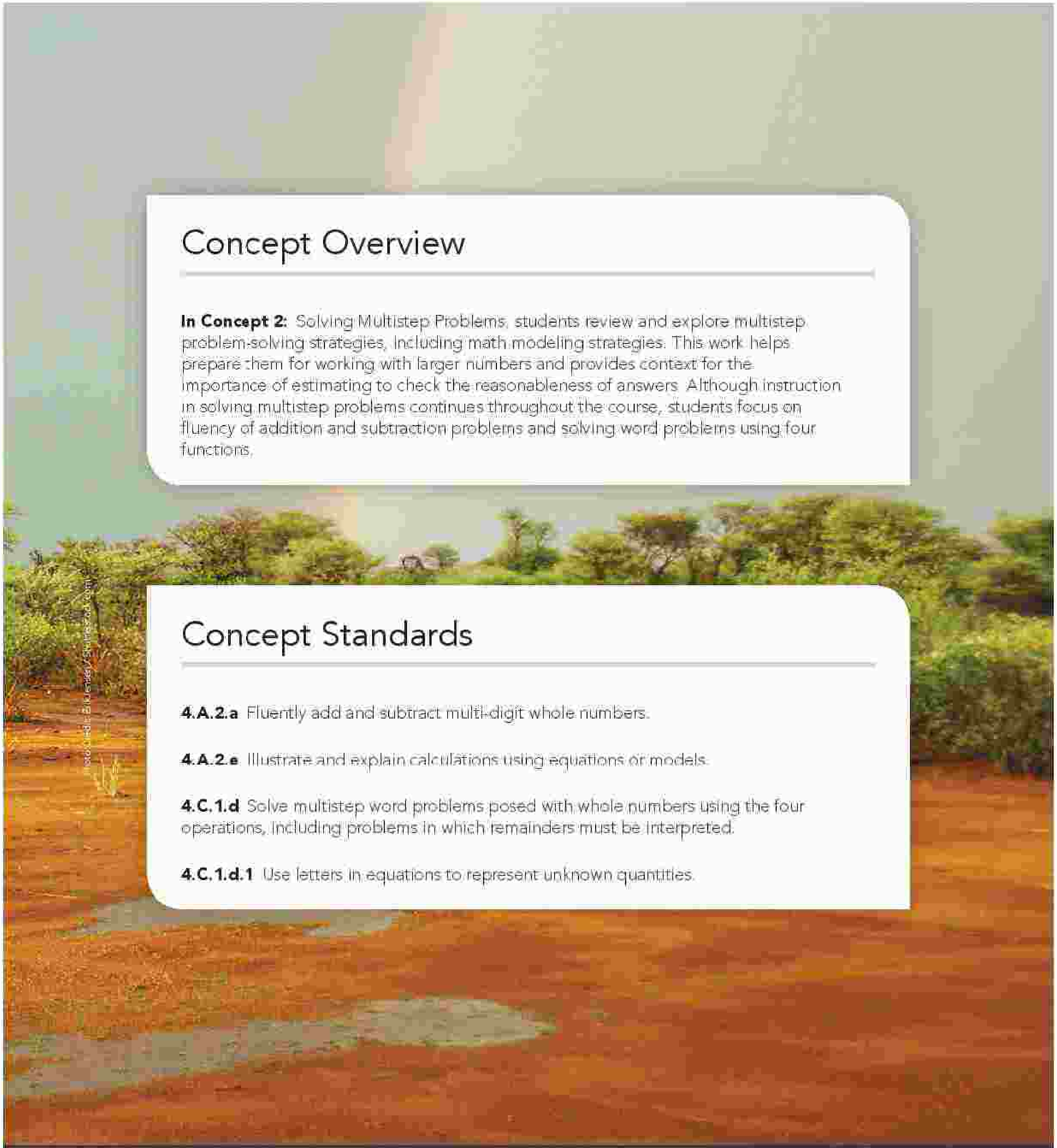
	• Explicitly state that since one bean was added to the second problem the sum of the first is one less. Point out the strategy on the anchor chart and read through the example together. • Repeat with a few more examples such as (28 + 13, 49 + 24). Use the beans to reinforce that adding one or two to one addend means having to subtract one or two from the actual sum. • **Subtraction**. Ask students to make a pile of 36 beans. Ask them to subtract 20 and whisper the answer. ASK • What would the answer be if only 19 beans were removed? • Why? • Have students physically remove 19 to find the new difference. • Practice with additional problems modeling compensation and having students share what they notice.

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CONCEPT 2

Solving Multistep Problems





Concept Overview

In Concept 2: Solving Multistep Problems, students review and explore multistep problem-solving strategies, including math modeling strategies. This work helps prepare them for working with larger numbers and provides context for the importance of estimating to check the reasonableness of answers. Although instruction in solving multistep problems continues throughout the course, students focus on fluency of addition and subtraction problems and solving word problems using four functions.

Concept Standards

4.A.2.a Fluently add and subtract multi-digit whole numbers.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.1 Use letters in equations to represent unknown quantities.

Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
6 Bar Models, Variables, and Story Problems	• No additional models are needed.	Bar model Variable	• Students will use letters to represent unknown quantities in equations. • Students will use bar models to represent and solve story problems. • Solve for the variable in an equation.	
7 Solving Multistep Story Problems with Addition and Subtraction	• Thinking Like a Mathematician anchor chart	Review vocabulary as needed.	• Students will solve multistep story problems. • Students will explain how they solved multistep story problems.	
Concept Check-In and Remediation	• Materials may vary.	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to solving multistep problems.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students struggle to determine what a variable represents and how to find the value. • Students may not demonstrate flexibility in how they find a variable in a fact family. They may not be able to see that there are several relationships between the other numbers.	Bar Models, Solving Equations with Variables, Writing About Math, Practice, Check Your Understanding
	• Students often look for keywords to indicate which operations are needed to solve story problems. However, keywords do not always work. • Students may not be able to formulate or implement a plan for solving multistep problems. • Students may not realize there is often a "hidden" question they must answer before they can solve multistep problems.	Putting It Together, Solving Multistep Story Problems, Writing About Math, Practice, Check Your Understanding
	• Students may struggle to determine what a variable represents and how to find the value. • Students often look for keywords to indicate which operations are needed to solve story problems. However, keywords do not always work. • Students may not be able to formulate or implement a plan for solving multistep problems. • Students may not realize there is often a "hidden" question they must answer before they can solve multistep problems.	Concept Check-In

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LESSON 6
Bar Models, Variables, and Story Problems

Lesson Overview

This lesson combines concepts students have explored in isolation—bar models, variables, and story problems. Students apply their understanding of each element to investigate the importance of maintaining balance in equations. Students use bar models to identify the unknown information in story problems, create equations to represent the mathematics in story problems, and solve to find the unknown. Because there is an inverse relationship between addition and subtraction, some students may use subtraction to solve the problems, while others will use addition. Both approaches are valid as long as the unknown is found and the equation remains balanced.

Lesson Essential Questions

- What are the different ways to add and subtract?
- Which strategies are the most efficient?
- How can estimation help me solve problems accurately?

Learning Objectives

In this lesson

- Students will use letters to represent unknown quantities in equations.
- Students will use bar models to represent and solve story problems.
- Students will solve for the variable in an equation.

Materials List

No additional materials needed

Preparation

No additional preparation needed

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Lesson 6
Bar Models, Variables, and Story Problems

Quick Code: egmt4058

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Grade-Level Standards

4.A.2.a Fluently add and subtract multi-digit whole numbers.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.1 Use letters in equations to represent unknown quantities.

Vocabulary Check-In

bar model, variable

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to determine what a variable represents and how to find the value.
- Students may not demonstrate flexibility in how they find a variable in a fact family. They may not be able to see that there are several relationships between the other numbers.

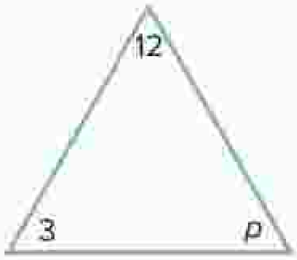
Introducing Variables

1. Ask students to stand and show with their bodies how something looks when in balance.

   TEACHER NOTE: This question is purposely open-ended so that students can show balance in a number of physical ways.

2. Ask a few volunteers to share their ideas. Reinforce that balance means the same (equal) on both sides.

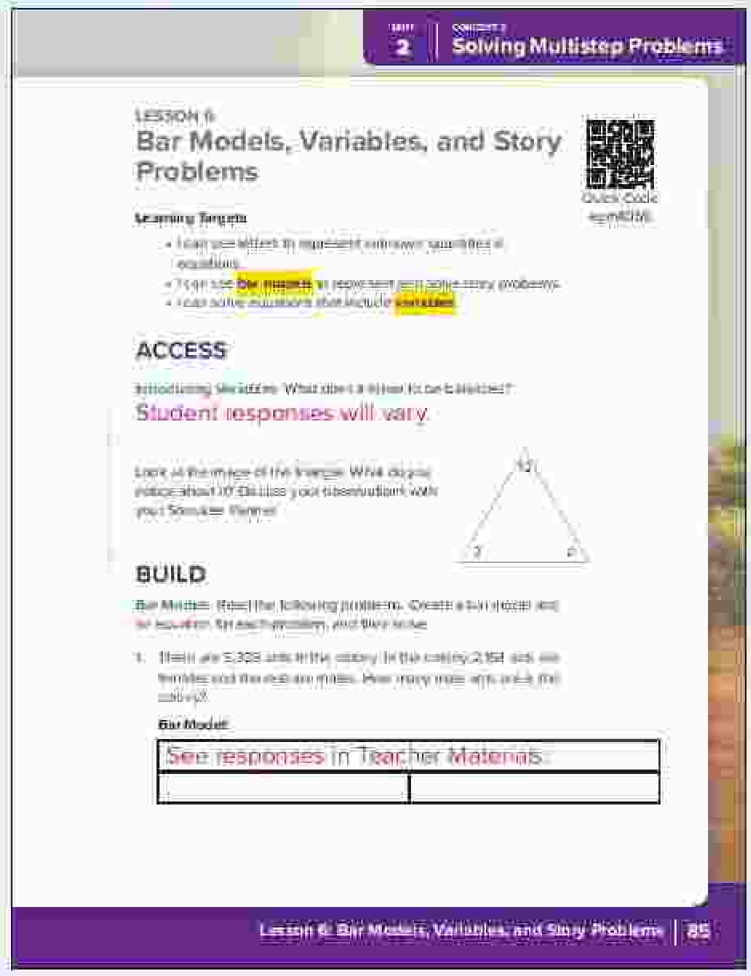
3. Ask students to turn to Lesson 6 ACCESS Introducing Variables and look at the triangle on the page. Then, ask students to share with their Shoulder Partner what they notice and wonder about the triangle.



4. After 1 minute, ask volunteers to share with the whole class what they notice and wonder. Reinforce the following:
   - The numbers are a fact family.
   - The letter *p* represents an unknown number.
   - The letter *p* could represent several options depending on how this problem is interpreted.

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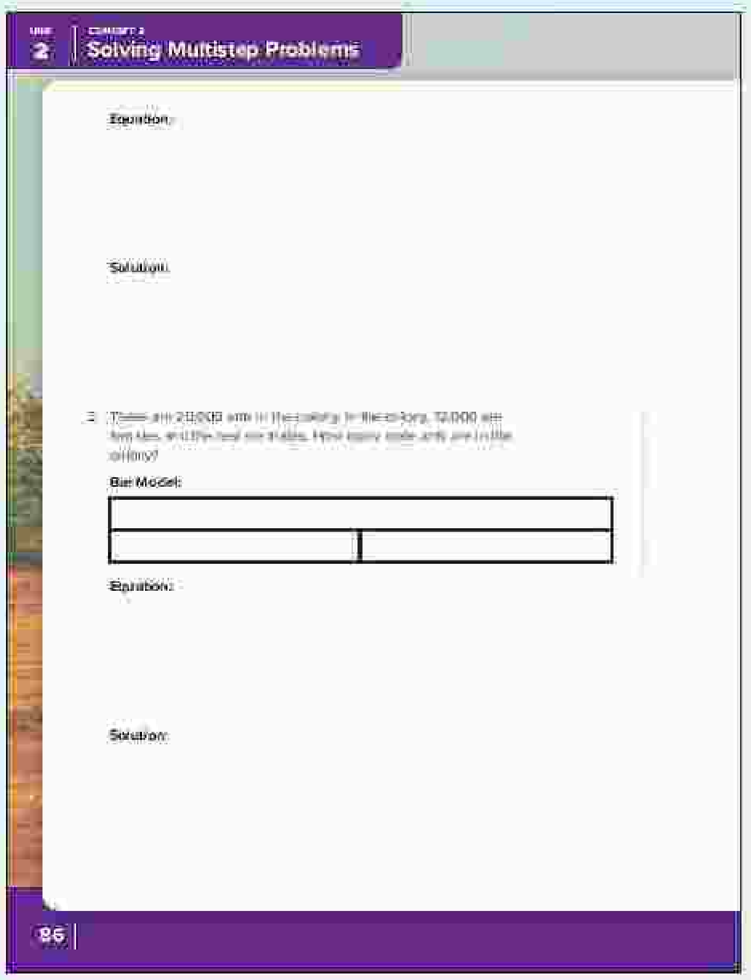
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2
Solving Multistep Problems

Equation:

Solution:

Bar Model:

Equation:

Solution:

86

- o p could = 4 if this were multiplication/division
- o p could = 15 or 9 if this were addition/subtraction

5. Remind students that in Primary 3 they saw unknown numbers as a box or symbol. Introduce the term variable and explain that a variable is a symbol that is a placeholder for a number. In Primary 4, they will use letters as variables to represent missing numbers in equations.

BUILD (40 min)

Bar Models (20 min)

TEACHER NOTE: Bar models were introduced in Primary 3 along with other part-whole graphic organizers. They are a useful tool for helping students to think about part-whole relationships. In this lesson, bar models help students organize the numbers in story problems and decide what operation is necessary to solve the problem.

1. Ask students to turn to Lesson 6 BUILD Bar Models and chorally read the Learning Targets. Then, ask a volunteer to read Problem 1 aloud.
2. Draw a bar model and label it as shown. Remind students of the bar models they used in Primary 3 to represent part-whole relationships.

Whole	
Part	Part

3. Ask students to check the problem and answer:

ASK

- *What is the whole?* 5,328
- *What is the known?* 2,164
- *What is the unknown?* variable

4. Record 5,328 as the whole, and 2,164 as the known part as students label their own bar model in their Student Materials. Explain to students that they can label the unknown part with a letter, and that this time you will use the letter x. Make sure students understand that choosing a different letter does not change the value of the variable.

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5,328	
2,164	x

5. Ask students to talk to their Shoulder Partner about how they might solve this problem. Remind students they can try to use any of the strategies they have practiced in previous lessons.
6. Use Calling Sticks to hear from 2 to 3 students. Once the first student has shared their thinking, ask if any students used different strategies. Ask them to explain and demonstrate how they found their answers.
7. Ask students to complete Problems 2–4 in the Student Materials. Caution students that some problems are worded differently, so they should read them carefully.

TEACHER NOTE: Depending on the needs of your students, some students may benefit from working with a partner or in a small group.

8. After about 10 minutes, go over the answers to the problems. Help students clear up any misconceptions and correct errors.

   TEACHER NOTE: Accept all variations on equations that include the correct whole, known part, and a variable to represent the unknown part. Students may choose to solve these problems as addition or subtraction problems. A collection of possible correct responses is shown for Problem 1.

Answer Key for Bar Models:

1.

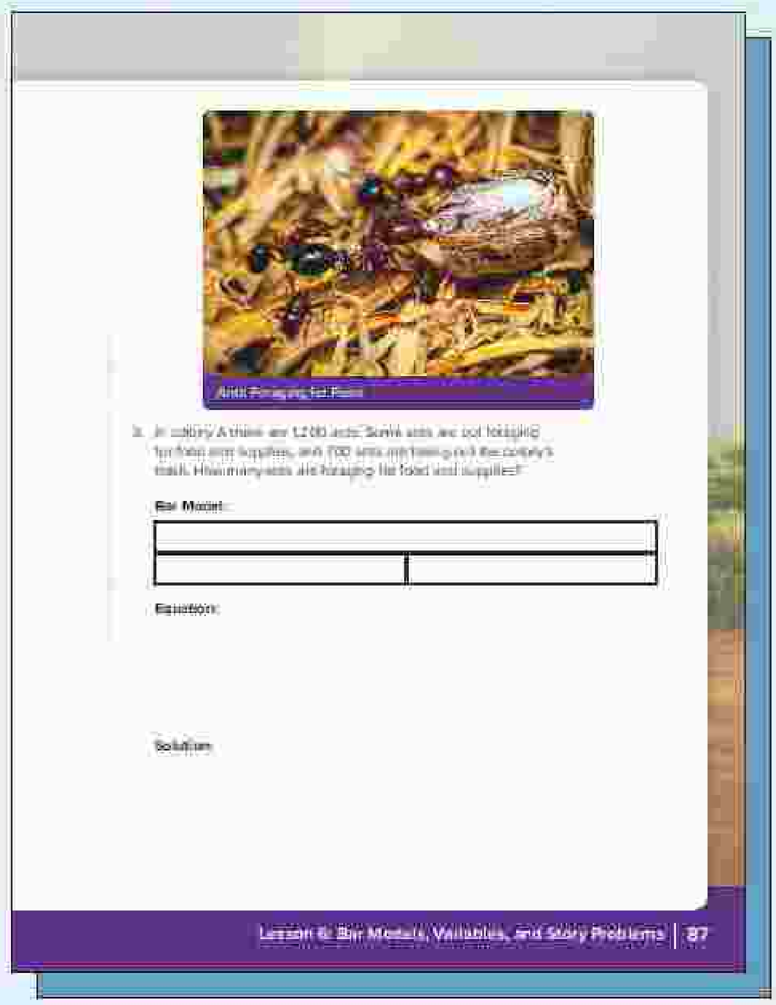
5,328	
2,164	a

5,328 – 2,164 = a; 2,164 + a = 5,328; 5,328 – a = 2,164; a + 2,164 = 5,328

a = 3,164

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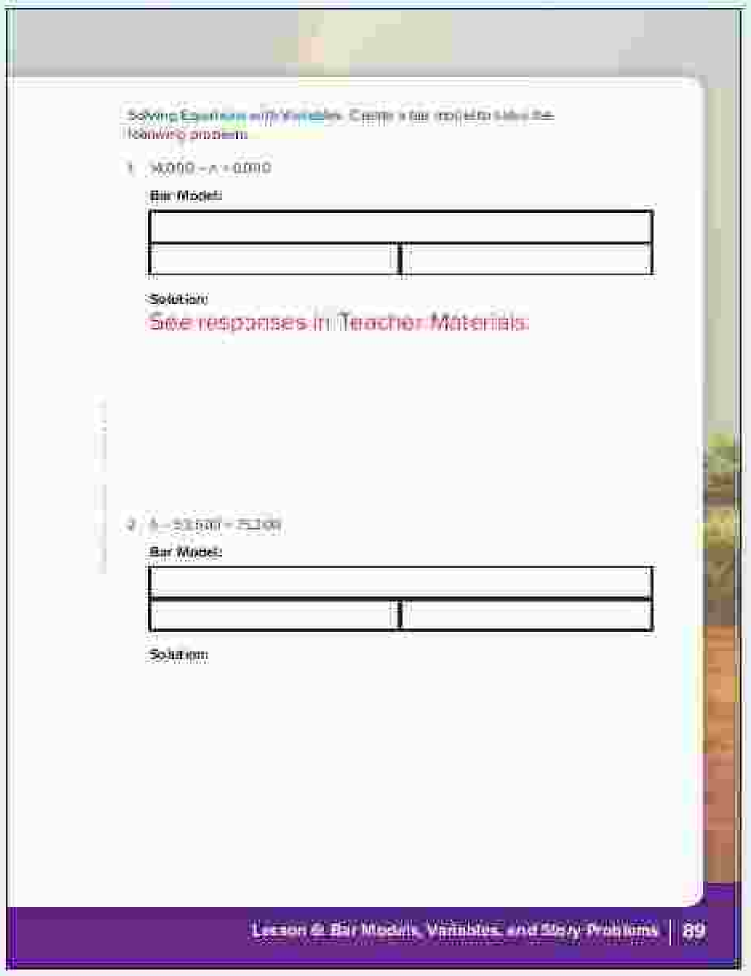
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Solving Equations with Variables: Create a bar model to solve the following problems.

1.

Bar Model:

Solution:

See responses in Teacher Materials.

2.

Bar Model:

Solution:

Lesson 6: Bar Models, Variables, and Story Problems | 89

2.

20,000	
12,000	*b*

20,000 – 12,000 = *b*

b = 8,000

3.

1,200	
700	*c*

1,200 – 700 = *c*

c = 500

4.

12,000	
2,500	*d*

12,000 – 2,500 = *d*

d = 9,500

Solving Equations with Variables (20 min)

1. Tell students that sometimes we have to solve equations with variables without the context of a story problem. However, we have a tool kit full of addition and subtraction strategies to help us think about what is known and what is unknown.
2. Direct students to turn to Lesson 6 BUILD Solving Equations with Variables and look at Problem 1. Write 14,000 – *n* = 6,000 = _______ on the board and ask students to discuss what the n represents in the equation. The unknown.
3. Ask students to Turn and Talk to a partner about how they would find the value of n.
4. Use Calling Sticks to select 2 to 3 students to share their thinking.
5. Ask students:
    - *What is whole in this problem?*
    - *What is the known part in this problem?*
    - *What would the bar model look like for this problem?*

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Draw a blank bar model on the board and ask a volunteer to record the whole and the known part.

- *How can you check if your answer is correct?* If it is not mentioned, model that students can check their work by replacing the unknown in the original problem with the solution to see if they get the whole.

6. Ask students to complete the rest of the problems in the Student Materials (either independently or with a partner).
7. When there are a few minutes left, review the answers and clarify any misconceptions or wrong answers.

Answer Key for Solving Equations with Variables:

1.

14,000	
6,000	n

$n = 8,000$

2.

75,200	
53,500	d

$d = 21,700$

3.

935,075	
725,625	c

$c = 209,450$

4.

13,280	
5,420	d

$d = 7,860$

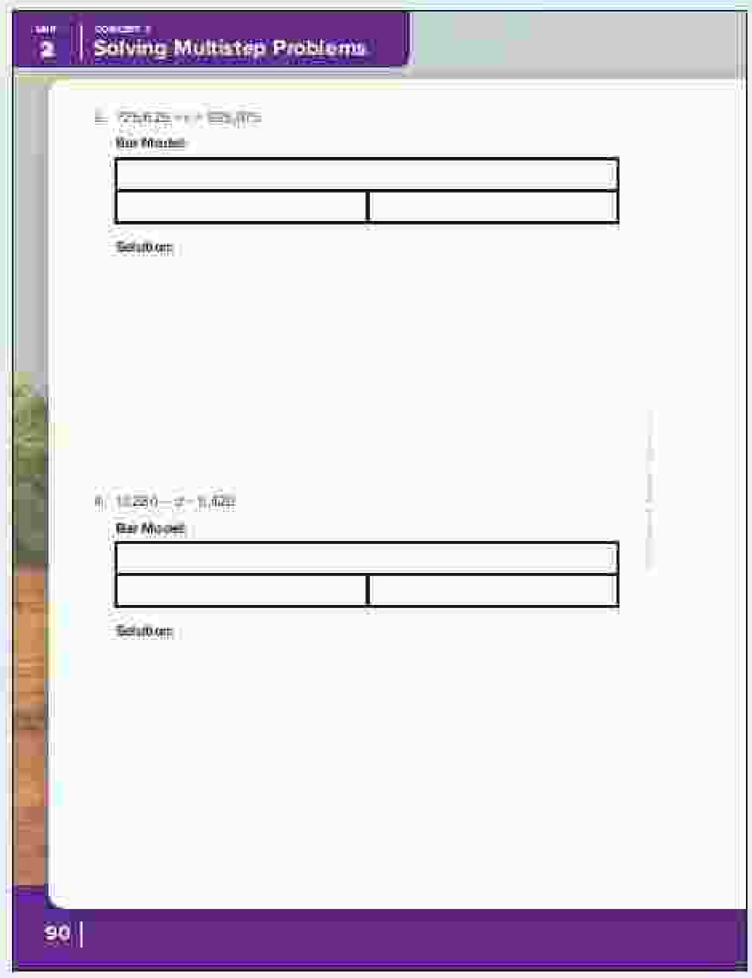
5.

810,775	
205,925	f

$f = 604,850$

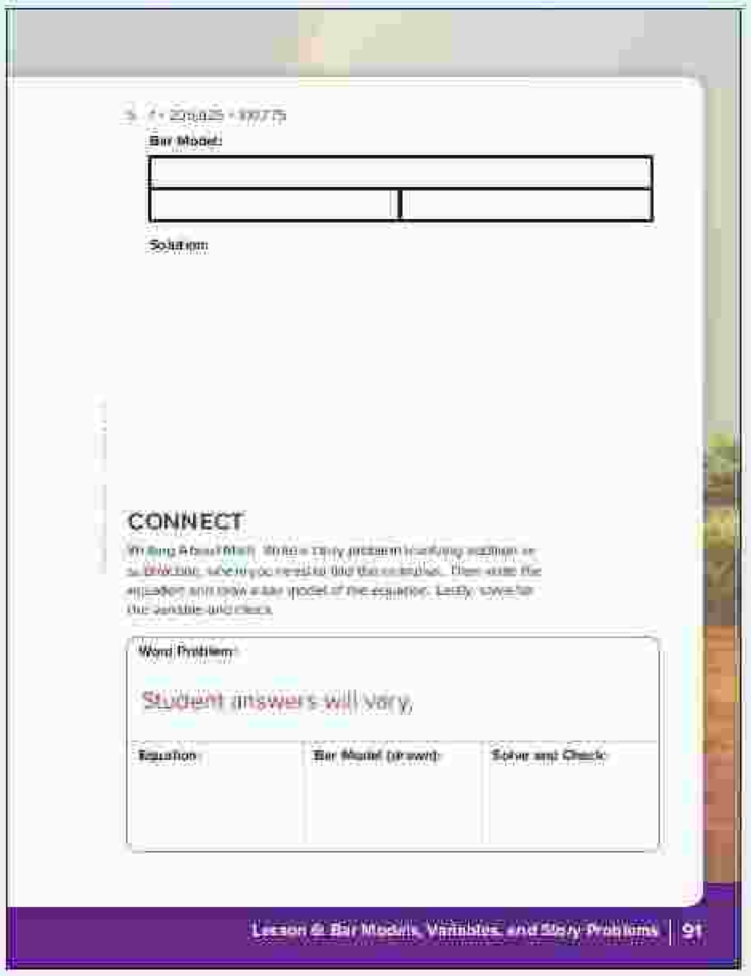
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CONNECT (7 min)

Writing About Math

1. Tell students that they will be writing a story problem to check their own understanding of part-whole story problems.
2. Ask students to turn to Lesson 6 CONNECT Writing About Math and read the prompt aloud. Make sure students understand the directions, and then have them begin working independently to respond to the prompt.

WRAP-UP (3 min)

Trade and Solve

1. Ask students to trade their Student Materials with their Shoulder Partner and solve each other's story problem.
2. If time allows, students should check each other's work.

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PRACTICE

Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Answer the questions. Show all of your work.

1. Seth took some steps on Monday. He walked 10,075 more steps on Tuesday. Now Seth has a total of 78,200 steps. How many steps did he take on Monday?

78,200	
10,075	a

Equation: 78,200 – 10,075 = a

Solution: a = 68,125

2. 152,350 = c + 42,125

152,350	
42,125	c

Solution: c = 110,225

3. z – 10,780 = 101,375

z	
10,780	101,375

Solution: z = 112,155

4. 425 + d = 15,000

15,000	
425	d

Solution: d = 14,575

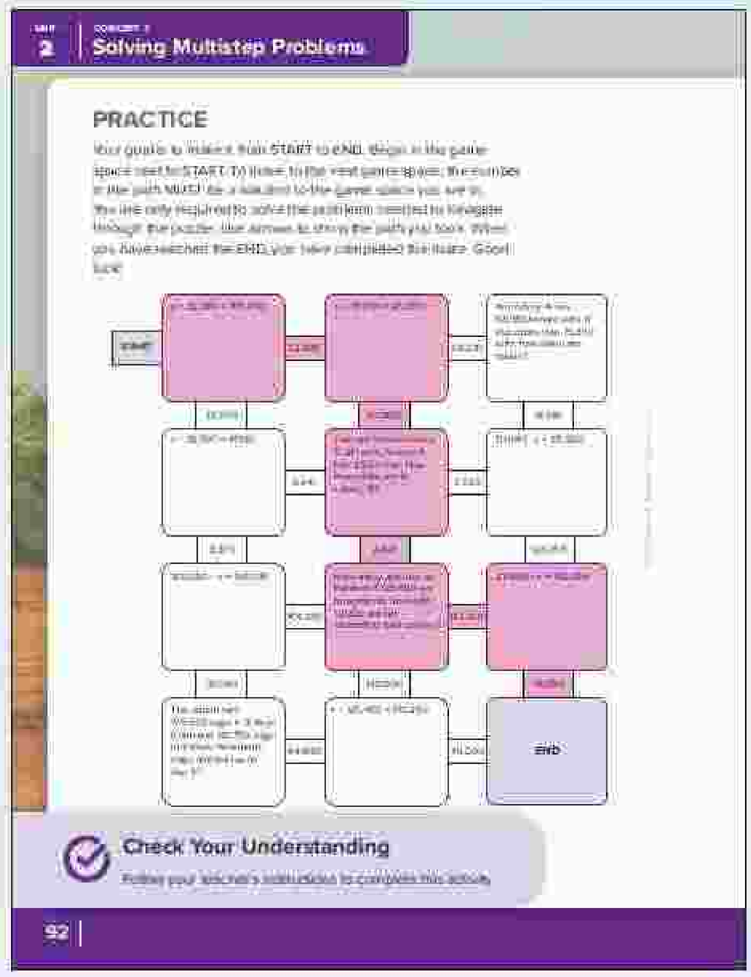
5. 7,691 – f = 1,000

7,691	
1,000	f

Solution: f = 6,691

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UNIT 2 | Solving Multistep Problems

PRACTICE

Check Your Understanding

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LESSON 7
Solving Multistep Story Problems with Addition and Subtraction

Materials List

No additional materials are needed.

Lesson Overview

In this lesson, students focus on the strategy of finding the "hidden" question in multistep story problems. They solve and explain the steps to solve multistep story problems with addition and subtraction.

Lesson Essential Questions

- What are the different ways to add and subtract?
- Which strategies are the most efficient?
- How can estimation help me solve problems accurately?

Learning Objectives

In this lesson

- Students will solve multistep story problems.
- Students will explain how they solved multistep story problems.

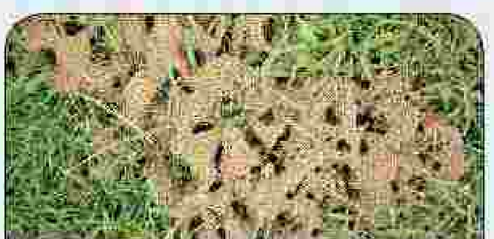
Grade-Level Standards

4.C.1.d Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

Vocabulary Check-In

Review vocabulary as needed.

DIGITAL



Lesson 7

Solving Multistep Story Problems with Addition and Subtraction

Quick Code: egmt4059

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

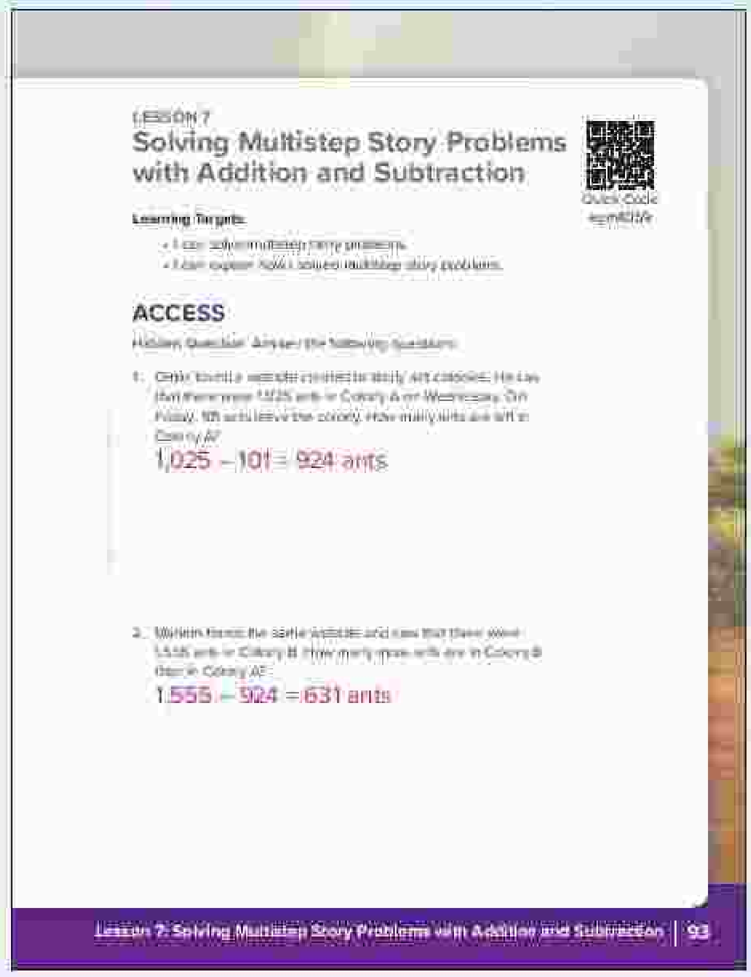
- Students often look for keywords to indicate which operations are needed to solve story problems. However, keywords do not always work.
- Students may not be able to formulate or implement a plan for solving multistep problems.
- Students may not realize there is often a "hidden" question they must answer before they can solve multistep problems.

Hidden Question

1. Direct students to Lesson 7 ACCESS Hidden Question. Ask a volunteer to read Problem 1 aloud.
2. Have students work independently or with a partner to solve the problem. Tell students to give a Thumbs Up when they are done.
3. After students are finished, ask them what operation they used to solve the problem. Go over the answer to Problem 1 on the board and allow students to correct their work if needed.
4. Direct students back to their Student Materials to read Problem 2 to themselves. Ask students to discuss what information they need to solve the problem. They need the information from the answer to Problem 1.
5. Ask students to solve Problem 2 independently or with a partner. After students are finished, ask them what operation they used to solve the problem. Go over the answer to Problem 2 on the board and allow students to correct their work if needed.
6. Explain that some story problems are two story problems put together. For example, we could put Problems 1 and 2 together to make a story problem. Explain that these problems are called multistep problems because we have to answer more than one question. Ask students to underline the two questions in Problems 1 and 2. How many ants are left in Colony A? and How many more ants does Mariam have in her colony than Omar?

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LESSON 7

Solving Multistep Story Problems with Addition and Subtraction

ACCESS

1. 1,025 – 101 = 924 ants

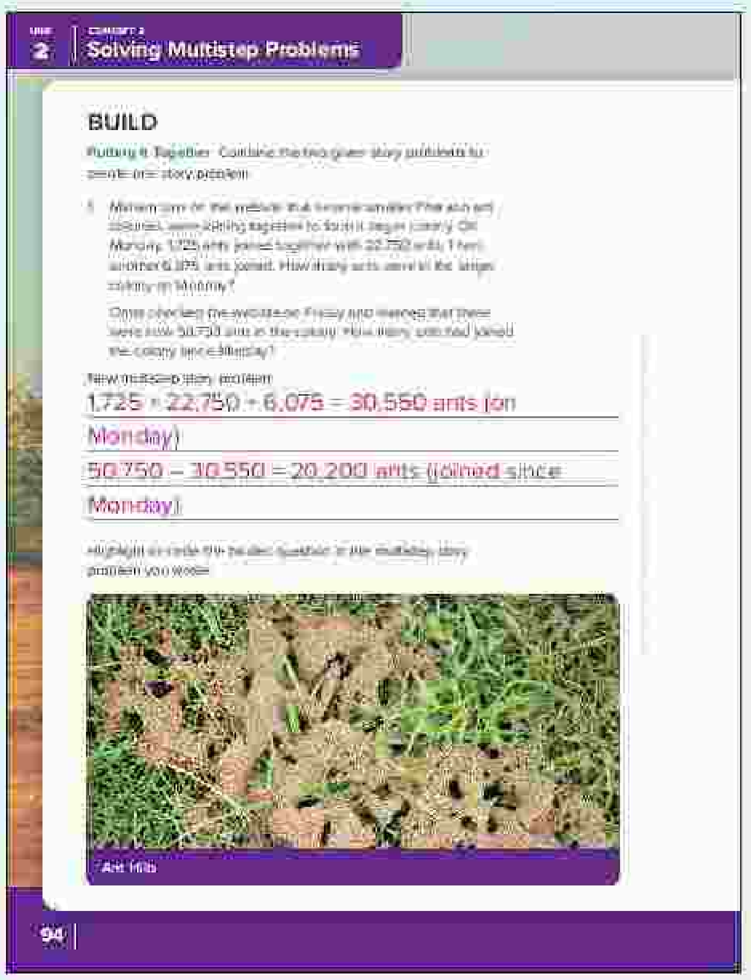
2. 1,555 – 924 = 631 ants

Lesson 7: Solving Multistep Story Problems with Addition and Subtraction | 93

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7. Ask students what would happen if we did not solve Problem 1. Would they be able to solve Problem 2? No. Allow students to share their thinking, and then explain that the question from Problem 1 is the "hidden" question—the question we must answer before we can solve Problem 2.

8. Explain to students that there is often a "hidden" question in multistep story problems and that they must answer that question before the can solve the whole problem.

Answer Key for Hidden Question:

1. 1,025 – 101 = 924 ants
2. 1,555 – 924 = 631 ants

BUILD (40 min)

Putting It Together (15 min)

1. Direct students to Lesson 7 BUILD Putting It Together and ask volunteers to read the story problems aloud.
2. Ask students to help you combine the two given story problems and rewrite them as one multistep story problem. Write the new story problem on the board. Ask students to record it in their Student Materials.
3. Ask students to reread the new problem and write the hidden question. (How many ants did Mariam count?)
4. Explain that sometimes the hidden question is not written in the problem. However, they still must determine what information is needed to solve the problem and solve to find that information. On the board, cross out the question "How many ants did Mariam count?"
5. Challenge students to solve the problem and compare their answers with their partner. Go over the answers together and remind students that good mathematicians show their work and persevere to solve challenging problems. Reference the Thinking Like a Mathematician anchor chart.

Answer Key for Putting It Together:

1. 1,725 + 22,750 + 6,075 = 30,550 ants (counted by Mariam)

   50,750 – 30,550 = 20,200 ants (left to be counted by Mariam)

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Solving Multistep Story Problems (25 min)

1. Explain to students that there are specific steps they can take to make sure they are answering all parts of a multistep problem. Direct students to Lesson 7 BUILD Solving Multistep Story Problems.
2. Ask volunteers to read the problem-solving steps aloud. Stop to discuss each step, making sure students understand what each step means and how the step might help them solve story problems.
3. Explain the directions for Problem 1. Students should read the problem, and then number the steps a student took to solve the problem so that they are in the right order. They should use the Steps to Solving Story Problems to guide their thinking. (Consider having students work in pairs so they can support each other.)
4. After a few minutes, ask students to share their thinking. Confirm the correct order of the steps.
5. Have students work independently or with a partner to solve Problems 2–4.
6. At the end of BUILD, go over the answers with students. If time allows, ask students to share the challenges they had. Ask other students to help provide insight and support, if possible.

Answer Key for Solving Multistep Story Problems:

1. 6 I subtracted 870 from 2,000. The answer is 1,130, so Ahmed can eat 1,130 more calories today.

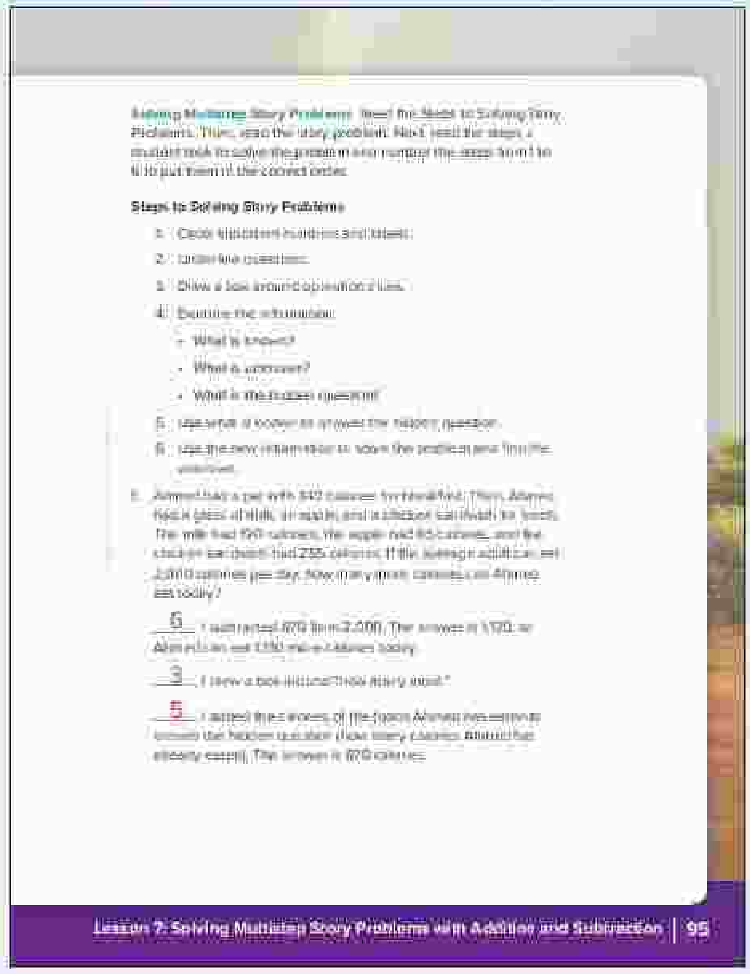
   3 I drew a box around "how many more."

   5 I added the calories of the foods Ahmed has eaten to answer the hidden question (how many calories Ahmed has already eaten). The answer is 870 calories.

   1 I circled 340 calories, 190 calories, 85 calories, 255 calories, and 2,000 calories.

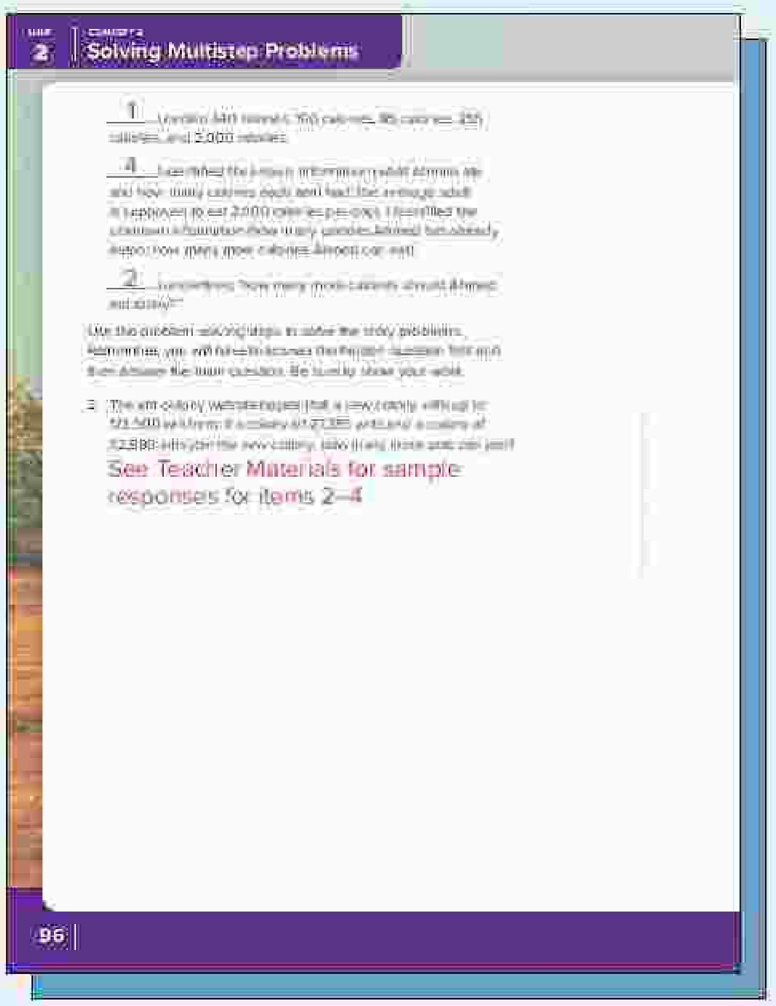
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2

Solving Multistep Problems

See Teacher Materials for sample responses for items 2–4

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4 I identified the known information (what Ahmed ate and how many calories each item had; the average adult is supposed to eat 2,000 calories per day). I identified the unknown information (how many calories Ahmed has already eaten; how many more calories Ahmed can eat).

2 I underlined "how many more calories should Ahmed eat today?"

2. 27,385 + 52,890 = 80,275

   173,500 − 80,275 = 93,225 ants

3. 59,000 + 27,525 + 32,975 = 119,500

   150,000 − 119,500 = 30,500 visitors

4. 429,999 + 108,951 = 538,950

   538,950 − 256,088 = 282,862 people

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CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 7 CONNECT Writing About Math and respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask volunteers to share their Writing About Math responses with the whole group. Commend students who volunteer.

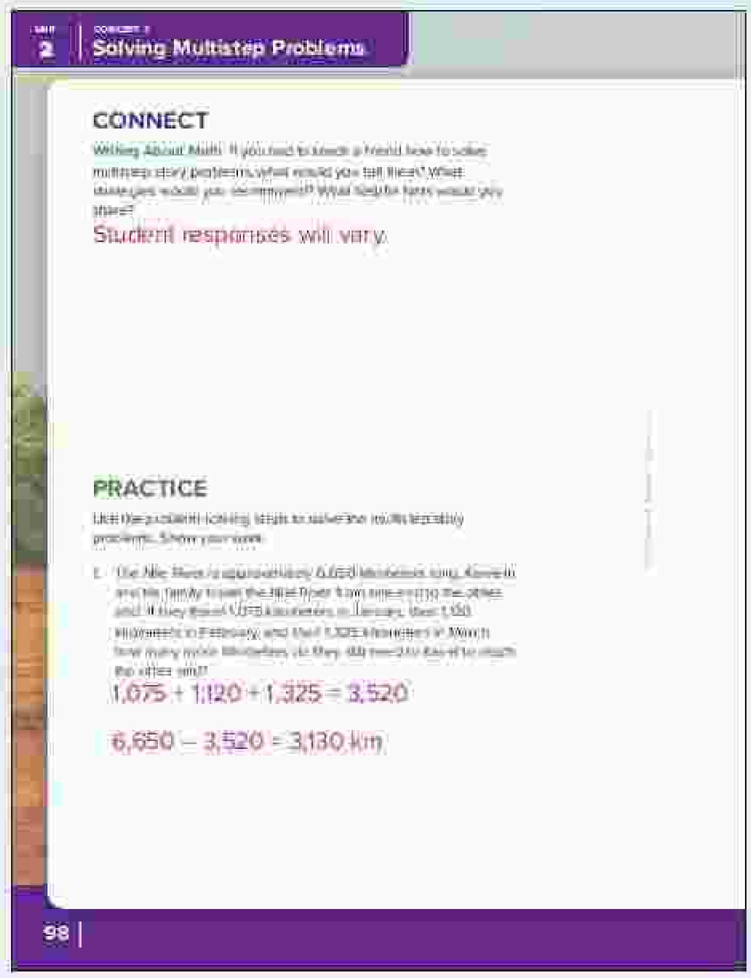
TEACHER NOTE: Consider using this Writing About Math entry as a formative assessment (not for a grade) to determine who needs additional support and instruction.

PRACTICE

Direct students to Lesson 7 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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UNIT 2 | CONCEPT 2
Solving Multistep Problems

CONNECT

Writing About Math: If you had to teach a friend how to solve multistep story problems, what would you tell them? What strategies would you recommend? What helpful hints would you share?

Student responses will vary.

PRACTICE

Use the problem-solving steps to solve the multistep story problems. Show your work.

1. [illegible]

1,075 + 1,120 + 1,325 = 3,520

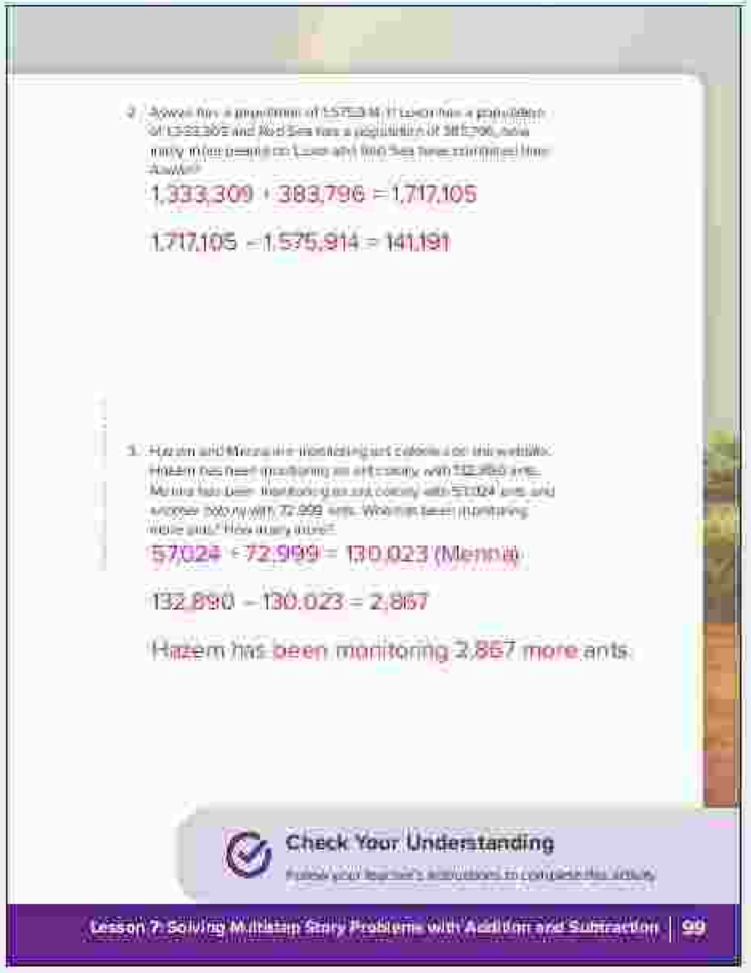
6,650 − 3,520 = 3,130 km

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1,333,309 + 383,796 = 1,717,105

1,717,105 − 1,575,914 = 141,191

57,024 + 72,999 = 130,023 (Menna)

132,890 − 130,023 = 2,867

Hazem has been monitoring 2,867 more ants.

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 7: Solving Multistep Story Problems with Addition and Subtraction | 99

Check Your Understanding

Use the problem-solving steps to solve the multi-step story problems. Show your work.

1. The Suez Canal extends from Port Said to the city of Suez and is 193,120 meters long. If a boat travels 38,620 meters each day for 5 days, how many more meters will it need to travel to reach the end of the canal?

   38,620 + 38,620 + 38,620 + 38,620 + 38,620 = 193,100 or 38,620 × 5 = 193,100

   193,120 – 193,100 = 20 meters

2. Matrouh has a population of 429,999. If North Sinai has a population of 474,401 and South Sinai has a population of 108,951, how many more people live in North Sinai and South Sinai combined than in Matrouh?

   474,401 + 108,951 = 583,352

   583,352 – 429,999 = 153,353 people

3. Salma was counting ants in colony A. She counted 1,525 ants on Monday, 19,750 ants on Tuesday, and 3,705 ants on Wednesday. If there are 30,520 ants in colony A, how many more ants does she still need to count?

   1,525 + 19,750 + 3,705 = 24,980

   30,520 – 24,980 = 5,540 ants

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Solving Multistep Problems. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What are the different ways to add and subtract?
- Which strategies are the most efficient?
- How can estimation help me solve problems accurately?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to solving multistep story problems.

Grade-Level Standards

4.A.2.a Fluently add and subtract multi-digit whole numbers.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multi-step word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.1 Use letters in equations to represent unknown quantities.

Vocabulary Check-In

Review concept vocabulary as needed

Materials List

Materials may vary

Preparation

Preparation may vary

DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4060

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COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to determine what a variable represents and how to find the value.
- Students often look for keywords to indicate which operations are needed to solve story problems. However, keywords do not always work.
- Students may not be able to formulate or implement a plan for solving multistep problems.
- Students may not realize there is often a "hidden" question they must answer before they can solve multistep problems.

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Remediation: Correcting Misconceptions

If...	Then...
Students struggle to determine what a variable represents and how to find the value.	Review BUILD from Lesson 6. Consider having students look for places where a letter is used to represent a word. For example, 12 = N on an AC (12 numbers on an analog clock); 4 = S in a Y (4 seasons in a year); 60 = M in an H; 24 = H in a D; 12 = M in a Y; and so on. Discuss how letters can represent numbers, too, too. Use manipulatives to help them solve small-number addition and subtraction problems with unknowns.
If...	**Then...**
Students do not understand what they are being asked, especially when the problem includes a hidden question.	Review Putting It Together from Lesson 7. Consider having students draw or map out story problems to identify what they know and what they do not know. Manipulatives can help make the concepts less abstract.
If...	**Then...**
Students cannot formulate or implement a plan for solving a multistep problem.	Review Steps to Solving Story Problems from Lesson 7. Work through several story problems with students, guiding them through the problem-solving steps each time. Visualization can be helpful to some students, as well. Ask students to see what is happening in the problem in their minds and determine what is missing.



UNIT

3

CONCEPTS OF MEASUREMENT

Theme 1 | Number Sense and Operations

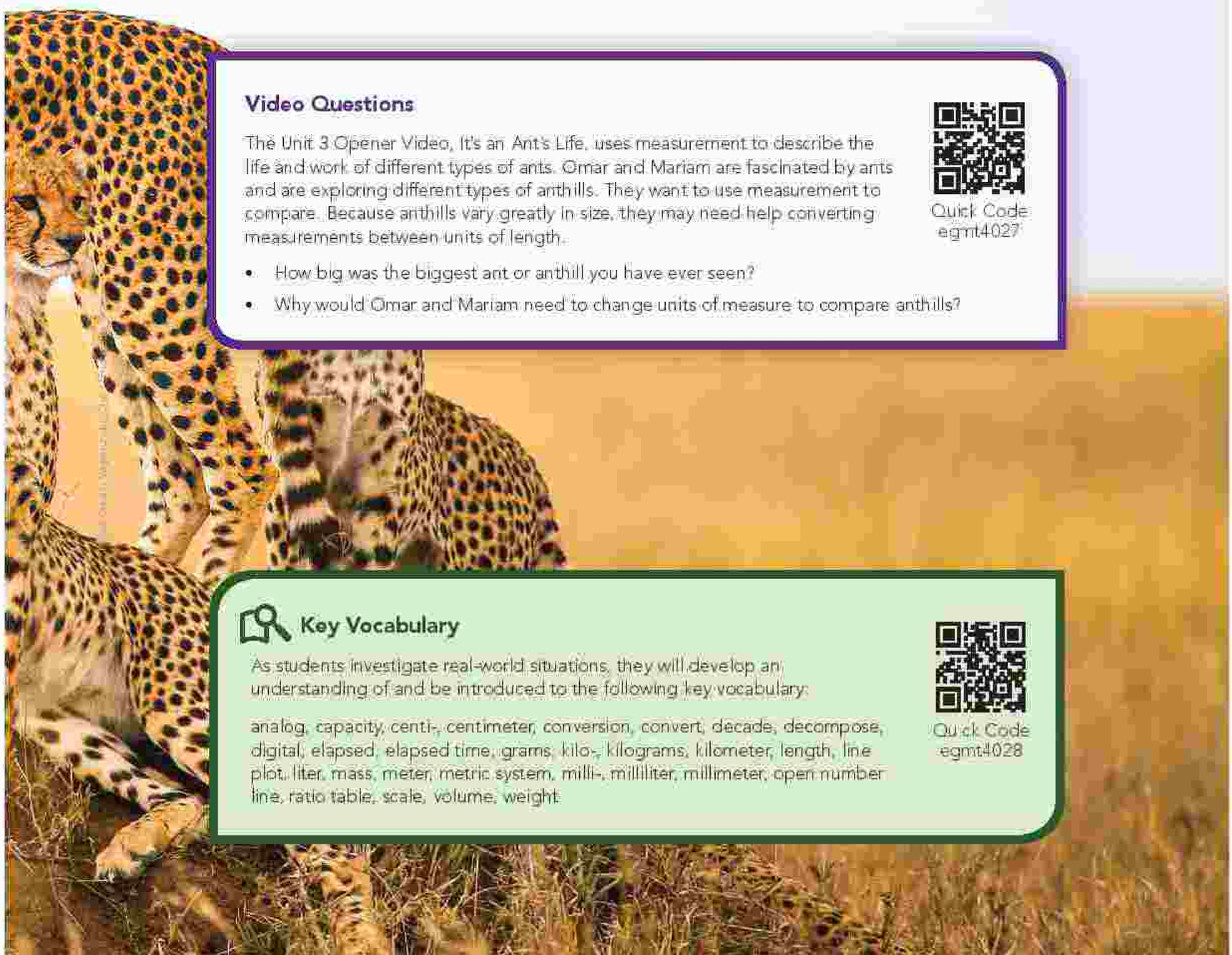
Unit 3 Concepts of Measurement



ESSENTIAL QUESTIONS

- How are metric units of measurement related to each other?
- What are the relationships between units of time?
- How can I represent and interpret data with a scaled number line?
- What strategies are most effective and efficient for me when solving problems?

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Video Questions

The Unit 3 Opener Video, It's an Ant's Life, uses measurement to describe the life and work of different types of ants. Omar and Mariam are fascinated by ants and are exploring different types of anthills. They want to use measurement to compare. Because anthills vary greatly in size, they may need help converting measurements between units of length.

Quick Code
egmt4027

- How big was the biggest ant or anthill you have ever seen?
- Why would Omar and Mariam need to change units of measure to compare anthills?

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

analog, capacity, centi-, centimeter, conversion, convert, decade, decompose, digital, elapsed, elapsed time, grams, kilo-, kilograms, kilometer, length, line plot, liter, mass, meter, metric system, milli-, milliliter, millimeter, open number line, ratio table, scale, volume, weight

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Unit Storyline

Unit 3 Concepts of Measurement Storyline

The Concepts of Measurement unit extends students' working knowledge of how to use a centimeter ruler, determine appropriate units of measurement, and when to use an exact measurement versus an estimation. Students apply these learnings to story problems to further their understanding and ability to move between many metric units of length measurement and analyze data. To support learning, students observe video footage and investigate problems related to ant communities to enhance their understanding of measurement.

Unit Standards

4.D.1	Solve problems involving measurement and conversion of measurements.
4.D.1.a	Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).
4.D.1.b	Use the four operations to solve story problems involving distances, intervals of time, liquid capacity, masses of objects, and money.
4.D.1.c	Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

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Unit 3 Structure and Pacing

This structure and pacing guide is based on a Mathematics program that is 60 minutes/5 days a week. See the Alternate Pacing Guides for recommendations for 45-minute and 90-minute lessons.

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.

Concept 1: Metric Measurement

Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Lesson 1	**Ant Travel** **Learning Objectives** • Students will explain the relationship between metric units of length. • Students will convert between metric units of length. **Student Learning Targets** • I can explain the relationship between metric units of length. • I can convert between metric units of length.
Lesson 2	**The Weight Can Wait** **Learning Objectives** • Students will explain the relationship between metric units of mass. • Students will convert between metric units of mass. **Student Learning Targets** • I can explain the relationship between metric units of mass. • I can convert between metric units of mass.

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Unit Structure and Pacing *cont'd*

Lesson 3	**Fill It Up** **Learning Objectives** • Students will explain the relationship between metric units of capacity. • Students will convert between metric units of capacity. **Student Learning Targets** • I can explain the relationship between metric units of capacity. • I can convert between metric units of capacity.
Lesson 4	**Measurement and Unit Conversions** **Learning Objectives** • Students will compare place value relationships and measurement conversions. • Students will use multiplication and division to convert units of measurement. **Student Learning Targets** • I can compare place value relationships and measurement conversions. • I can use multiplication and division to convert units of measurement.
	Concept Check-In and Remediation **Learning Objectives** • Students will work to correct misconceptions and errors related to converting metric units of length, mass, and volume. **Student Learning Targets** • I can correct my misconceptions and errors related to converting metric units of length, mass, and volume.

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Concept 2: Time and Scaled Measurements

Essential Questions

- What are the relationships among units of time?
- Which problem-solving strategies are most effective and efficient for me?
- How can I represent and interpret data using a scaled number line?

Lesson 5	**What Time Is It?** **Learning Objectives** • Students will tell time to the minute. • Students will explain relationships between units of time. **Student Learning Targets** • I can tell time to the minute. • I can explain relationships between units of time.
Lesson 6	**How Long Does It Take?** **Learning Objectives** • Students will explain elapsed time. • Students will solve elapsed time problems. • Students will explain the strategies they use to solve elapsed time problems. **Student Learning Targets** • I can explain elapsed time. • I can solve elapsed time problems. • I can explain the strategies I use to solve elapsed time problems.

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Unit Structure and Pacing *cont'd*

Lesson 7	**Scaled Measurements** **Learning Objectives** • Students will create line plots to represent given data. • Students will select an appropriate key and scale for a line plot. • Students will write questions that can be answered by their line plots. **Student Learning Targets** • I can create a line plot based on given data. • I can select an appropriate key and scale for my line plot. • I can write questions that can be answered by my line plot.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to time and scaled number lines. **Student Learning Target** • I can correct my misconceptions and errors related to time and scaled number lines.

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Concept 3: Measurement All Around

Essential Question

- Which problem-solving strategies are most effective and efficient for me?

<table>
<tr><td>Lesson 8</td><td>

Measuring the World around Me Part 1

Learning Objectives

- Students will add and subtract to solve problems.
- Students will solve story problems involving measurement.
- Students will apply a variety of strategies to solve story problems.

Student Learning Targets

- I can add and subtract to solve measurement problems.
- I can solve story problems involving measurement.
- I can apply a variety of strategies to solve story problems.

</td></tr>
<tr><td>Lesson 9</td><td>

Measuring the World around Me Part 2

Learning Objectives

- Students will multiply and divide to solve problems.
- Students will solve story problems involving measurement.
- Students will apply a variety of strategies to solve story problems.

Student Learning Targets

- I can multiply and divide to solve measurement problems.
- I can solve story problems involving measurement.
- I can apply a variety of strategies to solve story problems.

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Concept Check-In and Remediation

Learning Objective

- Students will work to correct misconceptions and errors related to solving measurement story problems using the four operations.

Student Learning Target

- I can correct my misconceptions and errors related to solving measurement story problems using the four operations.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

Reduce ACCESS by 3 minutes

Reduce BUILD by 8 minutes

Reduce CONNECT by 2 minutes

Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section:

- Discuss fewer examples
- Eliminate Shoulder Partner conversations
- Shorten class discussions
- Work with students to complete ACCESS problems

If Mathematics instruction is based on a combination of 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

Follow the 45-minute approach for the 45-minute days.

Teach two 45-minute lessons on the 90-minute day.

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

Increase ACCESS by 5 minutes

Increase BUILD by 20 minutes

Increase CONNECT by 3 minutes

Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section:

- Discuss additional examples as needed
- Extend class discussions
- Allow time for hands-on work with manipulatives and models
- Provide additional practice problems for students who need additional practice
- Encourage students to share and model their problem-solving strategies

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Mathematical Background Knowledge

Metric Measurement, Time, Data, and Unit Conversions

In Primary 3, students measured using a centimeter ruler, determined appropriate units of measurement, and learned when an exact measurement could be used and when an estimate was appropriate. They also practiced converting between two metric units of length, mass, or capacity. In Primary 4 students work with conversions and story problems to further their understanding and ability to move between many metric units of length measurement. A focus for this conversion is to see the relationship between the Base Ten place value system and conversion in metric measurements. Students recognize patterns of converting units on the place value chart and change larger units to smaller units. Understanding conversions will lead to solving story problems using all four operations.

In Primary 3, students learned to tell time to the minute and solved simple elapsed time problems. In Primary 4, students focus on the relationship between units of time and convert between units to solve real world, elapsed time story problems.

In Primary 3, students used a line plot to represent and analyze a set of data. In Primary 4, students examine measurement data and create line plots with a measurement scale to represent data and analyze the data. Later in Primary 4, students create line plots with fractional units.

Solving Multistep Story Problems

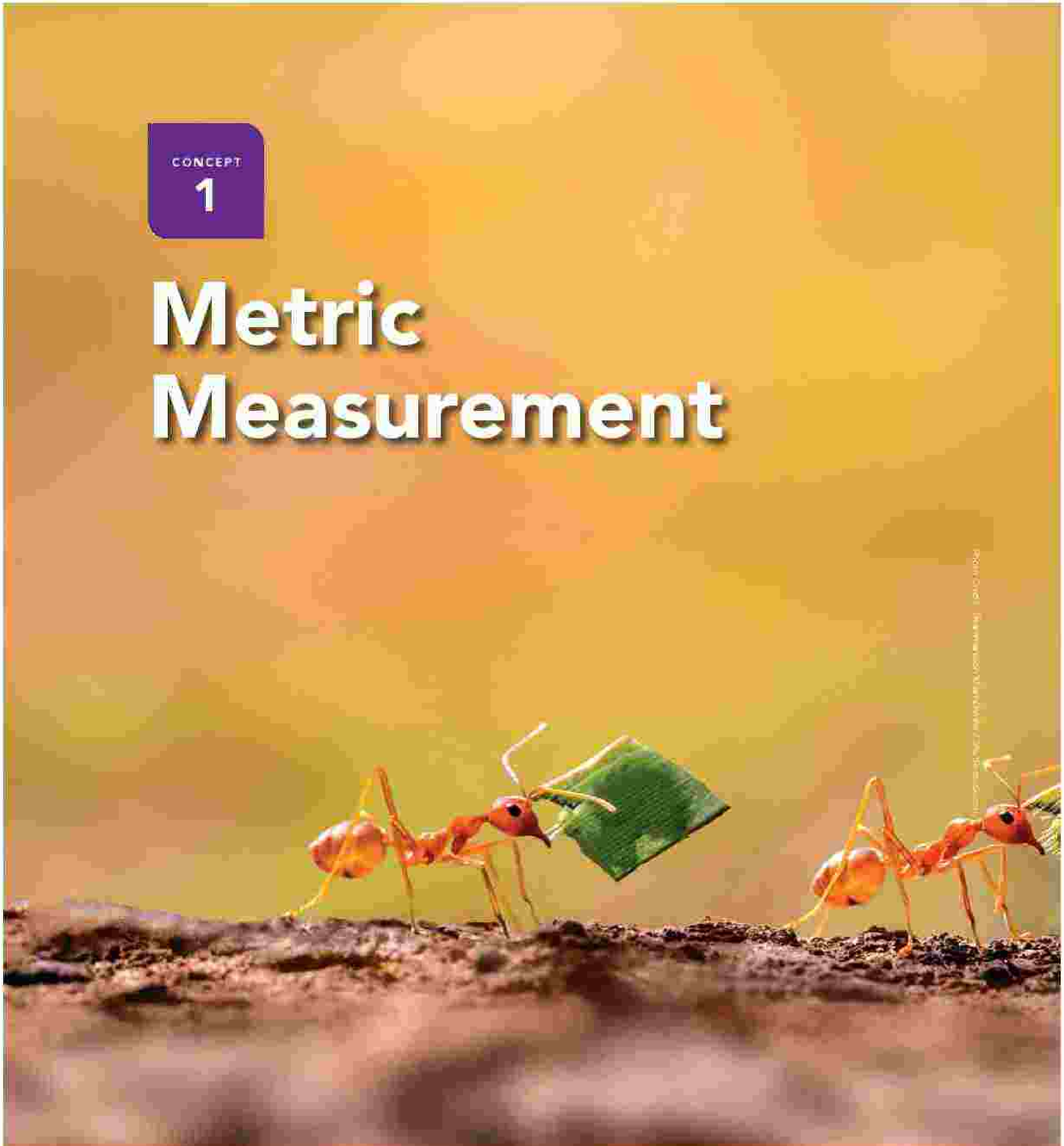
In Primary 3, students used place value concepts to convert between millimeters, centimeters, and meters and between grams and kilograms. They solved one- and two-step story problems involving length, mass, and time. In Primary 4, students use the four operations to solve multistep story problems involving distance, time, capacity, and mass. They investigate and apply a variety of problem-solving strategies, expanding their "toolkit" of strategies they can use to solve any type of story problem.

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CONCEPT

1

Metric Measurement



Concept Overview

In Concept 1: Metric Measurement, students review units of length, mass, and capacity and extend their understanding by investigating the relationships between units. Students make connections between the metric conversion chart and the place value chart, including the understanding that, as we move to the left in a place value chart, the value of the digit increases by 10 times. Students also recognize that the same measurement can be represented in multiple ways (for example, 100 centimeters is the same as 1 meter). Lessons 1, 2, and 3 are deliberately similar to help students see patterns in the metric system.

Concept Standards

4.D.1 Solve problems involving measurement and conversion of measurements.

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve story problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Concept Planner

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Ant Travel	• Metric Conversion chart (Create a large Metric Conversion chart). • Meter stick • Centimeter ruler • Excavated anthill image (In Student Materials)	Centi- Centimeter Convert Decompose Kilo- Kilometer Length Meter Metric system Milli- Millimeter	• Students will explain the relationship between metric units of length. • Students will convert between metric units of length.	
2 The Weight Can Wait	• An object that weighs about a gram (Paper clip or pen) • An object that weighs about a kilogram (A liter bottle of water, bag of rice, pineapple)	Grams Kilograms Mass Weight	• Students will explain the relationship between metric units of mass. • Students will convert between metric units of mass.	
3 Fill It Up	• A container with a capacity of 1 liter, such as a water bottle • A container with a capacity of 1 milliliter, such as a dropper • Diagram of 1-Liter Cylinder with mL Measurements (In Student Materials) • Large blank Measurement Terms anchor chart	Capacity Liter Milliliter Volume	• Students will explain the relationship between metric units of capacity. • Students will convert between metric units of capacity.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may struggle to remember conversions for metric units of length. • Students may confuse the units of measurement with what is being measured (length, mass, volume). • Students may compare or try to convert numbers without considering the units of measurement.	Measurement Review, Decomposing and Renaming Unit Conversions, The Nest, Practice, Check Your Understanding
	• Students may struggle to remember conversions for units of mass. • Students often confuse the units of measurement with what is being measured (length, mass, volume). • Students may compare numbers of measurement without considering the units.	Error Analysis, Conversion and Application, Writing About Math, Practice, Check Your Understanding
	• Students may struggle to remember conversions for metric units of capacity. • Students may struggle with story problems that require converting to the same units before solving. • Students often confuse the units of measurement with what is being measured (length, mass, volume). • Students may compare numbers of measurement without considering the units.	Number Talk, Decomposing and Renaming, Multistep Conversions, Math Language Review, Practice, Check Your Understanding

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
4 Measurement and Unit Conversions	• Metric Conversion chart (From Lesson 1)	Review vocabulary as needed.	• Students will compare place value relationships and measurement conversions. • Students will use multiplication and division to convert units of measurement.	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to converting metric units of length, mass, and volume.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• When converting units, students often divide instead of multiplying and vice versa.	Error Analysis, More Conversions, Writing About Math, Practice, Check Your Understanding
	• Students may struggle to remember metric conversions. • Students often confuse the units of measurement with what is being measured (length, mass, volume). • Students may compare numbers of measurement without considering the units. • When converting units, students often divide instead of multiplying and vice versa.	

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LESSON 1
Ant Travel

Lesson Overview

In this lesson, students discuss why measurement is important and what types of things we measure using units of length. They compare the relationships among millimeters, centimeters, meters, and kilometers and learn how to convert between units. Students complete conversion tables between units and answer story problems connecting back to their knowledge of ants.

Lesson Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will explain the relationship between metric units of length.
- Students will convert between metric units of length.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

centi-, centimeter, convert, decompose, kilo-, kilometer, length, meter, metric system, milli-, millimeter

Materials List

- Metric Conversion chart
- Meter stick
- Centimeter ruler
- Optional Video: Giant Anthill Excavated
- Lesson 1 Excavated Anthill Image (See end of volume)

Preparation

No additional preparation needed

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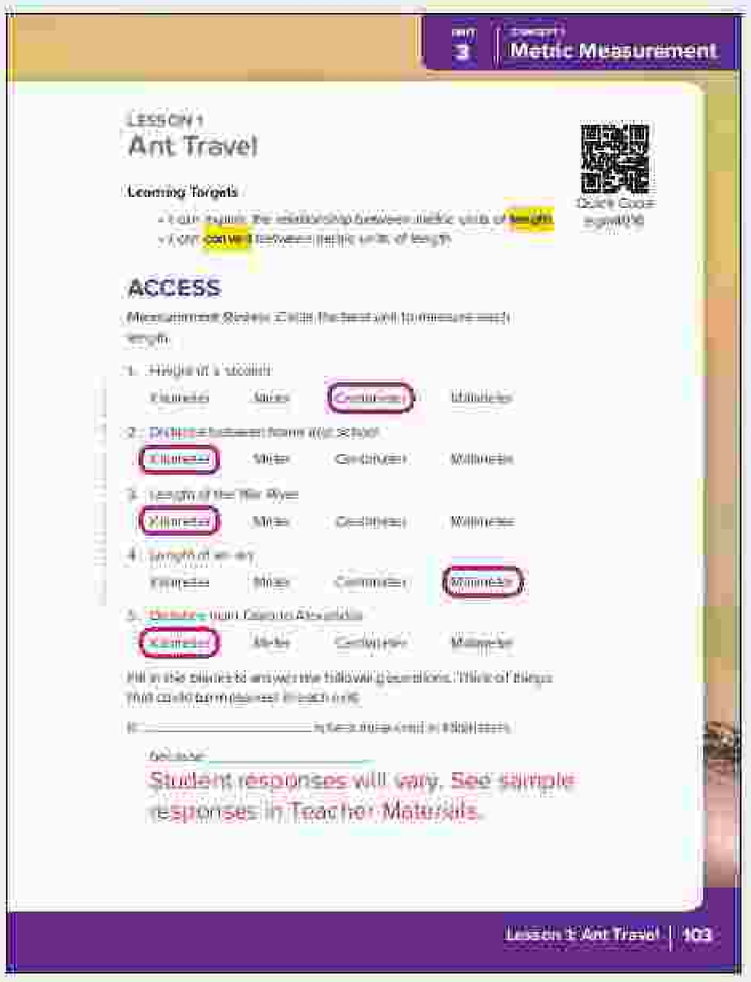


Lesson 1
Ant Travel

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to remember conversions for metric units of length.
- Students may confuse the units of measurement with what is being measured (length, mass, capacity).
- Students may compare or try to convert numbers without considering the units of measurement.

Measurement Review

1. Show students a meter stick and a centimeter ruler. Point out the meter, millimeter, and centimeter measurements.
2. Ask the class questions to promote a rich discussion about measurement, such as:
   - *What is the smallest unit of measurement on this tool?* (millimeter)
   - *What is the largest unit of measurement on this tool?* (meter)

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- *What could we measure with these tools?* (length of objects or distance between two places)
- *Why do we not have a kilometer ruler?* (it would be too long)
- *What do you notice about the words we use to describe units of length in the metric system?*
- *How would our measurement of the distance between home and school change if we used kilometers, meters, centimeters, or millimeters?*
    - o *What unit of measurement would make the most sense? Why do you think so?*
- *Could we measure the length of an ant in kilometers? Why or why not?*

3. Reinforce that lengths can be measured using any unit, but smaller numbers are easier to work with, which is why we say something is 5 kilometers instead of 5,000 meters, or 500,000 centimeters, or 5,000,000 millimeters. All of these numbers represent the same length, but 5 is easier to work with than 500,000,000. Also reinforce that smaller lengths cannot be measured as effectively with large units.
4. Direct students to Lesson 1 ACCESS Measurement Review and ask them to independently solve the problems.
5. Use Calling Sticks to choose students to share their work.

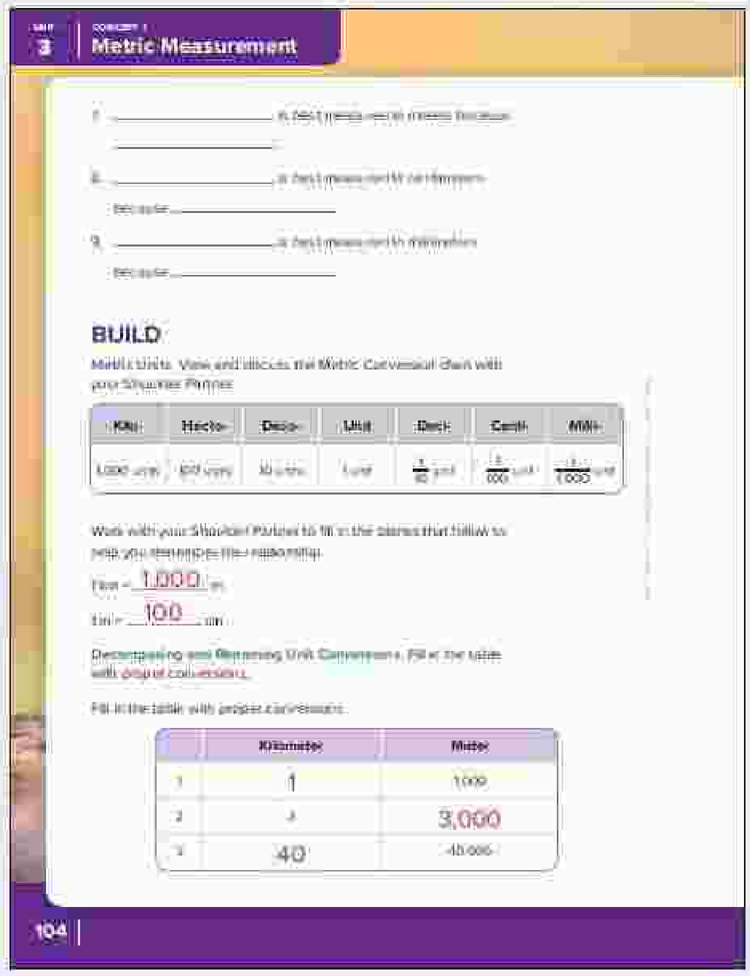
Answer Key for Measurement Review:

1. Height of a student: Meter or centimeter
2. Distance between home and school: Meter or Kilometer
3. Length of the Nile River: Kilometer
4. Length of an ant: Millimeter
5. Distance from Cairo to Alexandria: Kilometer

6–9: Answers will vary, but students should identify appropriate matches between objects or distances and the units of measurement.

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3 | Metric Measurement

BUILD

Kilo-	Hecto-	Deca-	Unit	Deci-	Centi-	Milli-

1,000

100

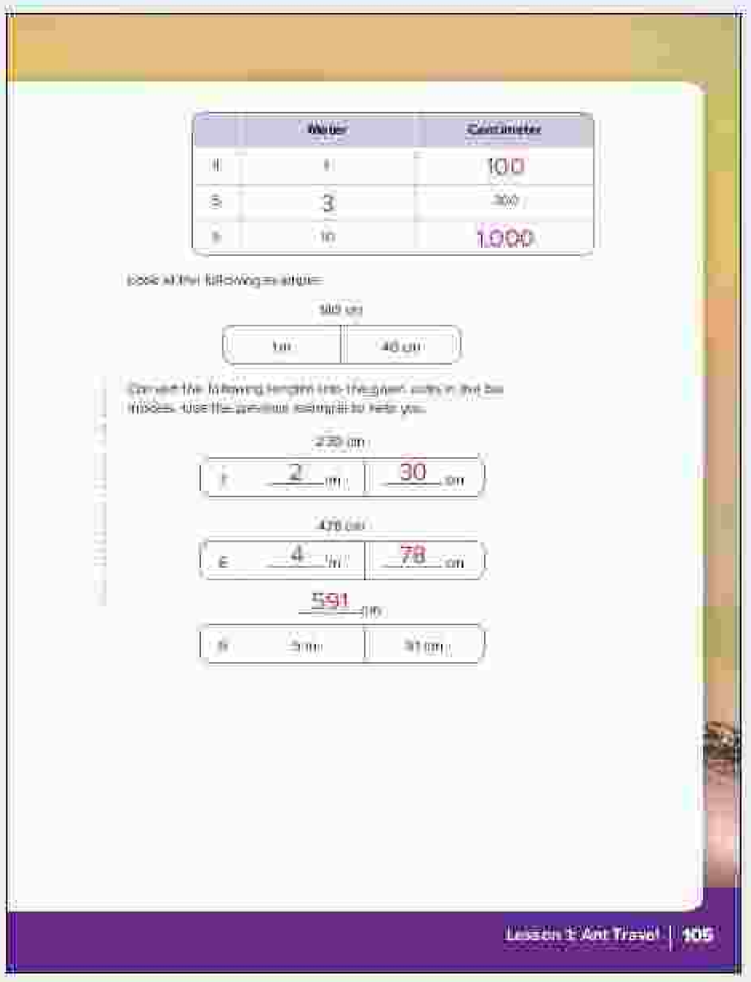
	Kilometer	Meter
1	1	
2		3,000
3	40	

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BUILD (40 min)

Metric Units (10 min)

For this activity, create a Metric Conversion chart for display, such as the one shown here:

Kilo-	Hecto-	Deca-	Unit	Deci-	Centi-	Milli-
1,000 units	100 units	10 units	1 unit	1/10 unit	1/100 unit	1/1,000 unit

1. Ask students to read the Learning Targets in Lesson 1: Ant Travel and self-assess their current understanding using Fist-to-Five.
2. Display the Metric Conversion chart. Ask Shoulder Partners to discuss what they notice about the chart.
3. After a minute, ask volunteers to share what they noticed. If no students mention it, explain that the chart shows the relationships between metric units of measurement. For example, if the center unit is 1 meter, the other units end in meter, such as centimeter and kilometer. As we move to the left in the chart, the units of measurement get larger. As we move to the right in the chart, the units of measurement get smaller.
4. Chorally practice reading each place value name, what it is worth, and how the different measurements relate to each other. For example, decameter is the same as 10 meters; hectometer is the same as 100 meters, and so on. A decameter is 10 times larger than a meter, but a decimeter is 10 times smaller.
5. Ask students to work with their Shoulder Partner to fill in the blanks to help them remember the relationship between kilometers and meters.
6. Ask students to identify the units of length with which they are most and least familiar.
7. Pose the following question to the class:

ASK

- *How are the relationships between metric units similar to the relationships between places on the place value chart?*

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8. Call on students to share their thinking. Record students' responses on the board.
   Students may see that when converting numbers, they increase or decrease by a power of 10. The places on a place value chart increase or decrease by powers of 10.

   TEACHER NOTE: This understanding will be further addressed in an upcoming lesson. Some students may immediately see the comparison, but others may not. This discussion lays the foundation for students to begin to see connections between units as they work through conversions.

Decomposing and Renaming Unit Conversions (30 min)

1. Explain to students that converting metric measurements is another way to decompose and compose numbers. The length of an object stays the same, but it can be renamed with different units. Explain that in today's lesson, the focus will be on kilometers (km), meters (m), and centimeters (cm) since these are the most common units of length measurement.
2. Ask students to turn to Lesson 1 BUILD Decomposing and Renaming Unit Conversions and work with their Shoulder Partner to complete Problems 1–6.
3. After a few minutes, review the answers as a class to ensure all students have the correct answers.
4. Direct students back to their Student Edition and ask them to look at the Conversion Example.

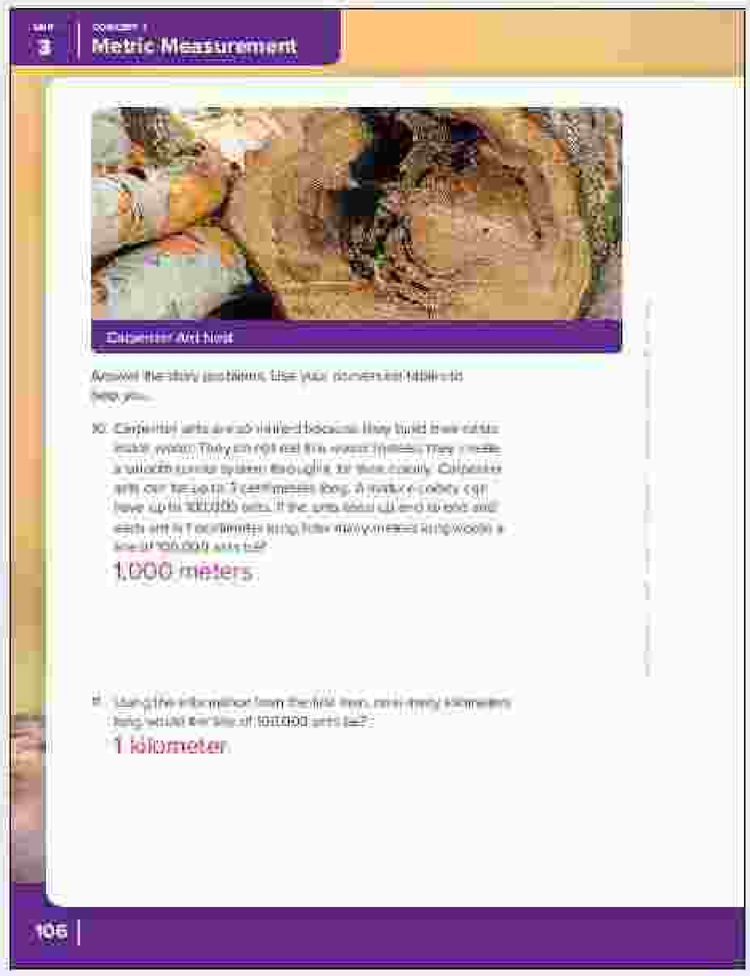
140 cm

1 m	40 cm

5. Explain that 140 centimeters can be converted, or decomposed, to 1 meter and 40 centimeters. The length does not change, but the units used to express that length are different.
6. Explain to students that the Conversion Example shows a bar model and not a scaled drawing. It is simply a representation of 140 centimeters. Remind them we use bar models as a tool to help us solve mathematical problems.

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UNIT 3 | CONCEPT 1
Metric Measurement

Carpenter Ant Nest

10. 1,000 meters

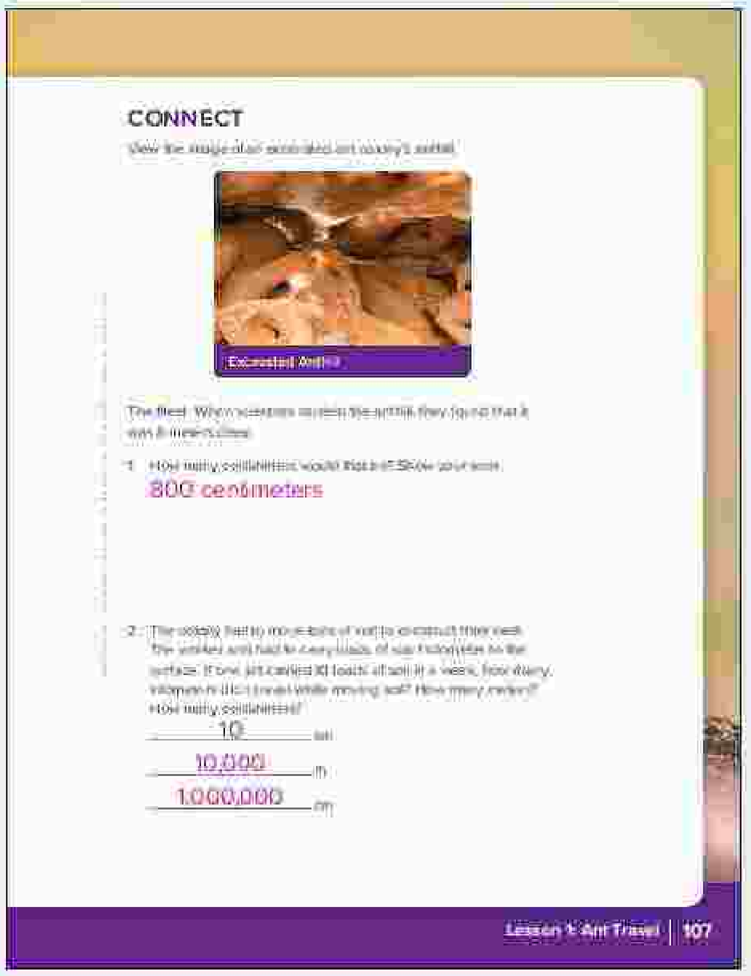
11. 1 kilometer

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7. Ask students to continue to work with their partner to solve Problems 7–11. If students are struggling, regroup the whole class and work through the problems with them.

   TEACHER NOTE If calculators are available, consider allowing students to use them to solve the story problem. The calculations are important, but it is more important that students perform the correct conversions.

8. During the last 5 minutes of BUILD, go over the answers with students. Ask students to discuss any questions they have and strategies they used that helped them solve the problems.

CONNECT (8 min)

The Nest

1. Ask students to turn to Lesson 1 CONNECT The Nest to view the image of the excavated anthill. Explain that a group of myrmecologists were interested in finding out more about the structure of an anthill but were not sure how to study it without destroying the structure. They decided to pour concrete into the hole. They poured concrete for 3 days – 10 tons of concrete. After the concrete was set, they brought in mechanical diggers to help them remove the soil. They discovered a vast network of tunnels that covered 50 square meters and went 8 meters down. To create the anthill, ants made billions of trips carrying 40 tons of soil out of the ground. In human terms, each ant carried a zebra about 1 kilometer to remove soil from their colony.
2. Ask students to complete Problems 1 and 2.

TEACHER NOTE This can be used as formative assessment to see the strategies the students use. Collect students' books to review their work.

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WRAP-UP (2 min)

Let's Chat About Our Learning

Explain that people measure length and distance all the time, and it can be useful to be able to quickly convert between units. Scientists use precise measurements when they collect and analyze data. Ask students to share examples of times when people might need to use precise measurements. If possible, find videos online of large anthill excavations to show students as additional support for the activities in CONNECT.

PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Convert to centimeters.

1. 6 m = 600 cm
2. 20 m 10 cm = 2,010 cm

Convert to meters:

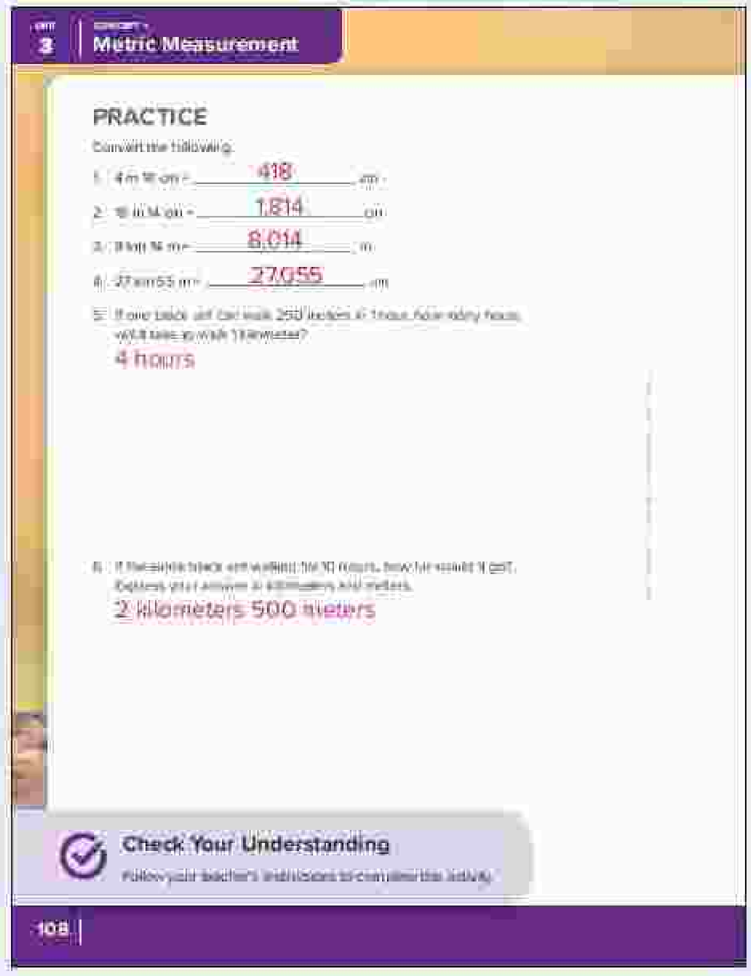
3. 23 km = 23,000 m
4. 800 km 50 m = 800,050 m
5. 5,950 m = 5 km 950 m

Lesson 1 Excavated Anthill Image



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UNIT 3 | CONCEPT 1 Metric Measurement

PRACTICE

1. 418 cm
2. 1,814 cm
3. 8,014 m
4. 27,055 m
5. 4 hours
6. 2 kilometers 500 meters

Check Your Understanding

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Materials List

- An object that weighs about a gram (paper clip or pen)
- An object that weighs about a kilogram (a liter bottle of water, bag of rice, pineapple)

Preparation

No additional preparation needed.

Photo Credit: [illegible] / Shutterstock.com

DIGITAL



Lesson 2

The Weight Can Wait

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LESSON 2
The Weight Can Wait

Lesson Overview

In this lesson, students review mass and convert between grams and kilograms, the most common units of mass. They begin with an error analysis of a mistake commonly made during conversions of units of length. Students work with conversion tables and story problems to further their understanding of mass.

Lesson Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will explain the relationship between metric units of mass.
- Students will convert between metric units of mass.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

grams, kilograms, mass, weight

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

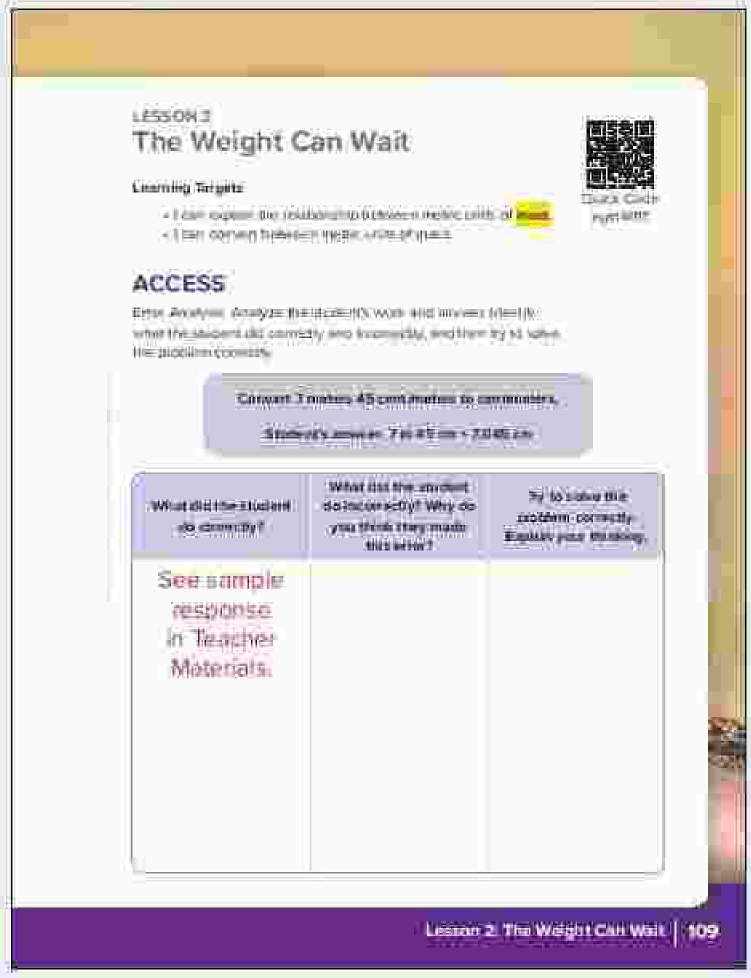
- Students may struggle to remember conversions for units of mass.
- Students often confuse the units of measurement with what is being measured (length, mass, volume).
- Students may compare or try to convert numbers without considering the units of measurement.

Error Analysis

1. Direct students to Lesson 2 ACCESS Error Analysis to complete the error analysis.
2. After most students are finished, go over the answers as a class.
   The student correctly kept the additional 45 centimeters in the conversion. However, the student incorrectly converted meters to centimeters by multiplying by 1,000 instead of 100. The correct answer is 745 cm.

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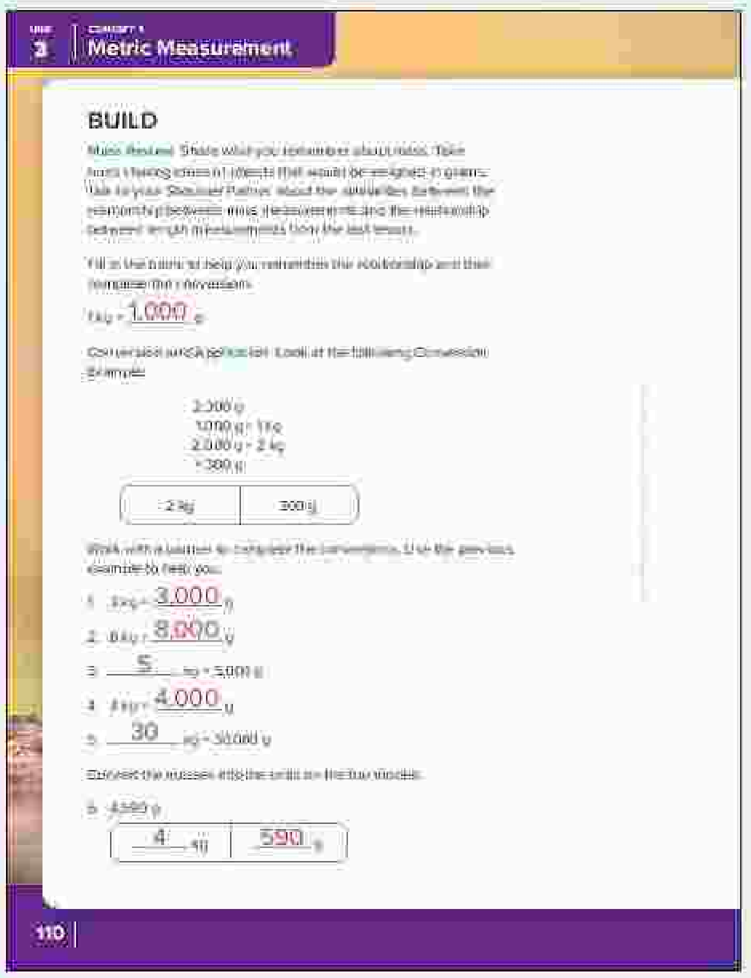
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Metric Measurement

BUILD

1 kg = 1,000 g

2,300 g
1,000 g = 1 kg
2,000 g = 2 kg
+ 300 g

2 kg	300 g

1. 3 kg = 3,000 g
2. 8 kg = 8,000 g
3. 5 kg = 5,000 g
4. 4 kg = 4,000 g
5. 30 kg = 30,000 g

6. 4,590 g

4 kg	590 g

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BUILD (40 min)

Mass Review (10 min)

1. Explain to students that today they will look at a different form of measurement: mass. Remind students that they first learned about mass in Primary 2 and studied it again in Primary 3. Ask students to share what they remember about mass. Share any of the following points that students do not share.
   - Mass is usually measured in grams or kilograms.
   - Gram and kilogram units are often referred to as "weights," but they are actually measures of mass, or how much matter is in an object.
   - An object's MASS is consistent and unchanging no matter where the object is—on Earth, on a mountain, at the bottom of the ocean, or on the moon.
   - However, an object's WEIGHT can change. For example, an object has a different weight on the moon than it does on Earth due to the effects of gravity.
   - Since students are measuring all objects here on Earth, it is okay if they use the word weight from time to time to help them build understanding of mass. However, remind them that mass and weight are not the same.
2. Show students the examples of objects that weigh about 1 gram and 1 kilogram. Explain that it takes 1,000 grams to create 1 kilogram.
3. Ask the students to Popcorn ideas of objects that would be weighed in grams (a pencil, spices, ants) and kilograms (people, sacks of vegetables or fruit, a chair).

   TEACHER NOTE: Kilograms and grams are the most commonly used units for measuring mass. Students will be introduced to other units during Lesson 4 to further their understanding of the relationship between place value and the metric system. However, this lesson's focus is on learning how to convert between the most common units.

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4. Ask students to talk to their Shoulder Partner about the similarities between the relationship between mass measurements and the relationship between length measurements from the last lesson. Students should note that the relationships are similar because 1 kilometer is equal to 1,000 meters and 1 kilogram is equal to 1,000 grams. Students may notice additional similarities.
5. Ask students to turn to their Student Edition and fill in the blank to express the relationship between kilograms and grams.

Conversion and Application (30 min)

1. Ask students to turn to Lesson 2 BUILD Conversion and Application and look at the Conversion Example.

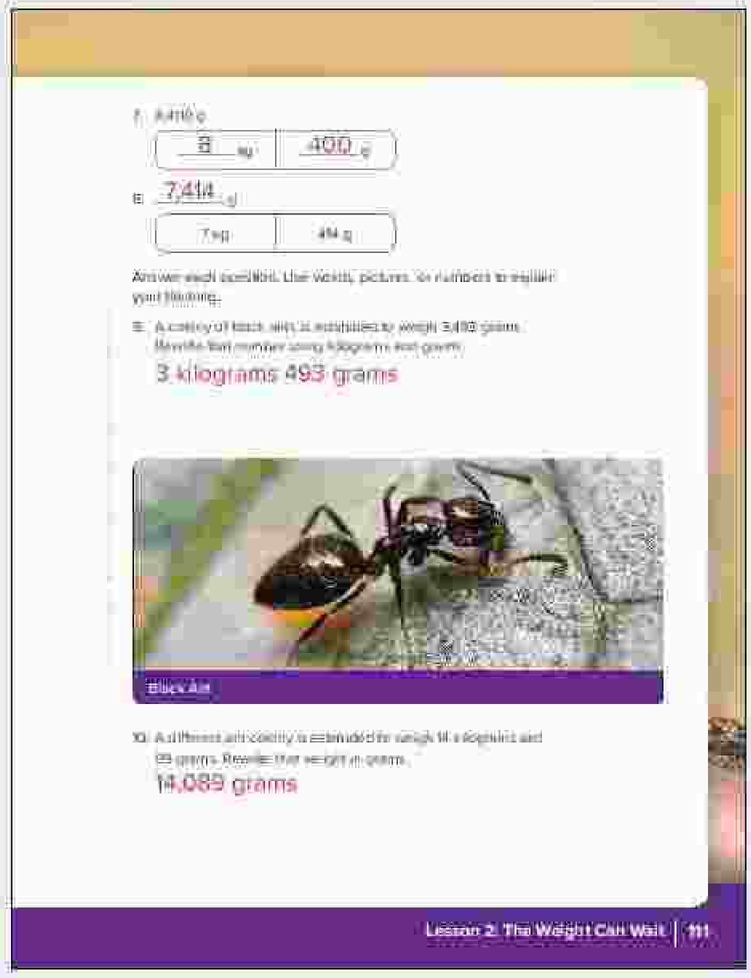
2,300 g

2 kg	300 g

2. Remind students this is a bar model and is a tool to help us as mathematicians. Discuss how 2,300 grams can be converted to 2 kilograms 300 grams. The mass is the same, but the units to express the mass are different.
3. Remind students that the prefix "kilo-" means 1,000 and there are 1,000 grams in 1 kilogram.
4. Ask students to work with a partner to solve Problems 1–10. If students are struggling, regroup the class and work through the problems together.
5. During the last 5 minutes of BUILD, go over answers with the students. Ask students to discuss any questions they still have and strategies they used that helped them solve the problems.

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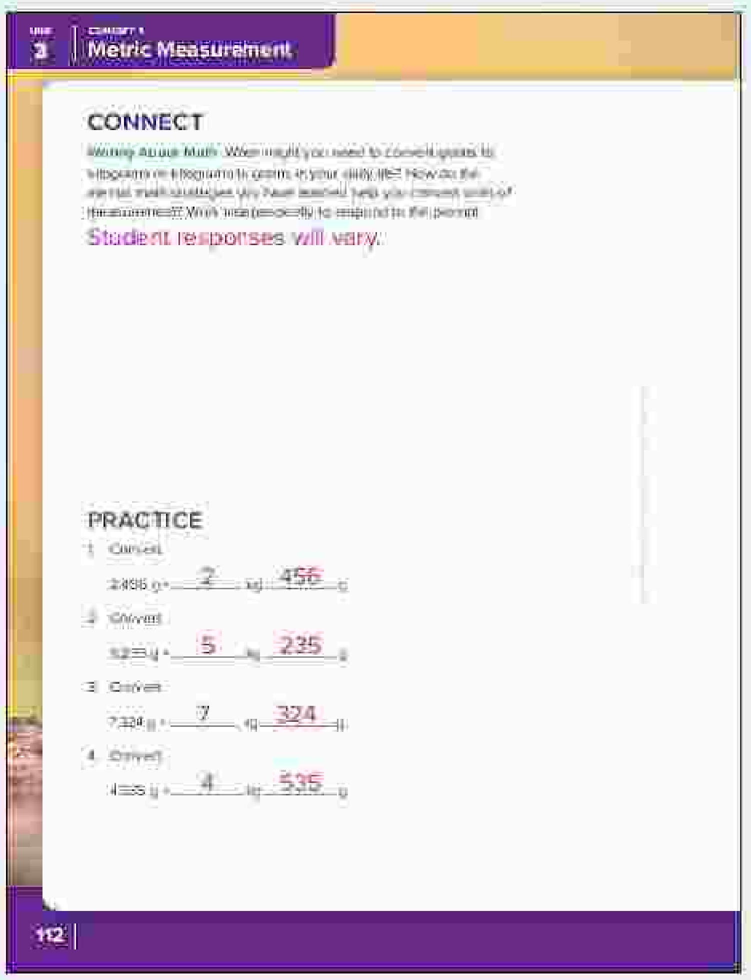
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UNIT 3 | CONCEPT 1 Metric Measurement

CONNECT

Writing About Math: When might you need to convert grams to kilograms or kilograms to grams in your daily life? How do the mental math strategies you have learned help you convert units of measurement? Work independently to respond to the prompt.

Student responses will vary.

PRACTICE

1. Convert.
2456 g = 2 kg 456 g
2. Convert.
5235 g = 5 kg 235 g
3. Convert.
7324 g = 7 kg 324 g
4. Convert.
4535 g = 4 kg 535 g

112

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 2 CONNECT Writing About Math. Ask a volunteer to read the prompt aloud. Then, have students work independently to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their writing with a partner. Then, ask volunteers to share their thinking with the class. Encourage students to ask questions of each other.

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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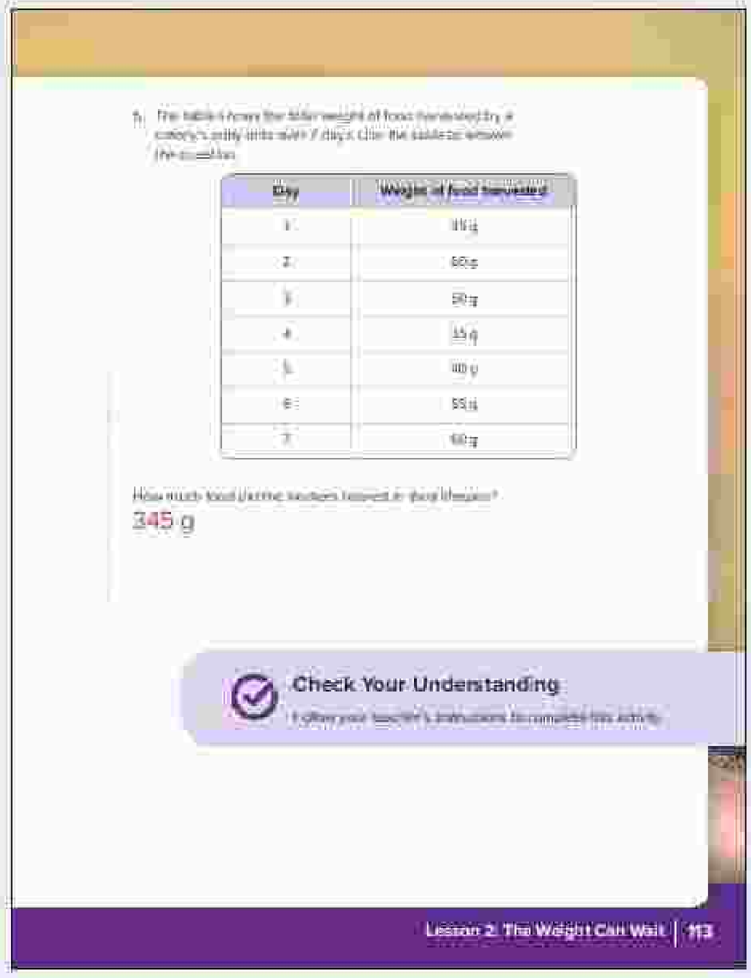
Check Your Understanding

Convert.

1. 3,806 g = 3 kg 806 g
2. 8 kg 50 g = 8,050 g
3. 3,425 g = 3 kg 425 g
4. 1 kg 10 g = 1,010 g
5. 10,452 g = 10 kg 452 g

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Materials List

- A container with a capacity of 1 liter, such as a water bottle
- A container with a capacity of 1 milliliter, such as a dropper
- Lesson 3 Diagram of 1-liter Cylinder with milliliter Measurements and Answer Key (See end of this volume)
- Large blank Measurement Terms anchor chart

Measurement Terms			
Length	Mass	Capacity/Volume	Time

Preparation

Create Measurement Terms anchor chart

Photo Credit: Vojce / Shutterstock.com

DIGITAL



Lesson 3

Fill It Up

Quick Code: egmt4018

LESSON 3
Fill It Up

Lesson Overview

In this lesson, students investigate metric units of capacity. They examine a scaled cylinder to determine that 1,000 milliliters is equivalent to 1 liter. They then convert different measurements and create tables to identify patterns when converting between milliliters and liters. Students look at a recipe with a combination of weight and capacity measurements and decipher between the two units. When solving story problems in this lesson, students must first convert to common units before solving. Finally, students check their understanding of measurement terms for each type of measurement covered in Lessons 1–3.

Lesson Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will explain the relationship between metric units of capacity.
- Students will convert between metric units of capacity.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

capacity, liter, milliliter, volume

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

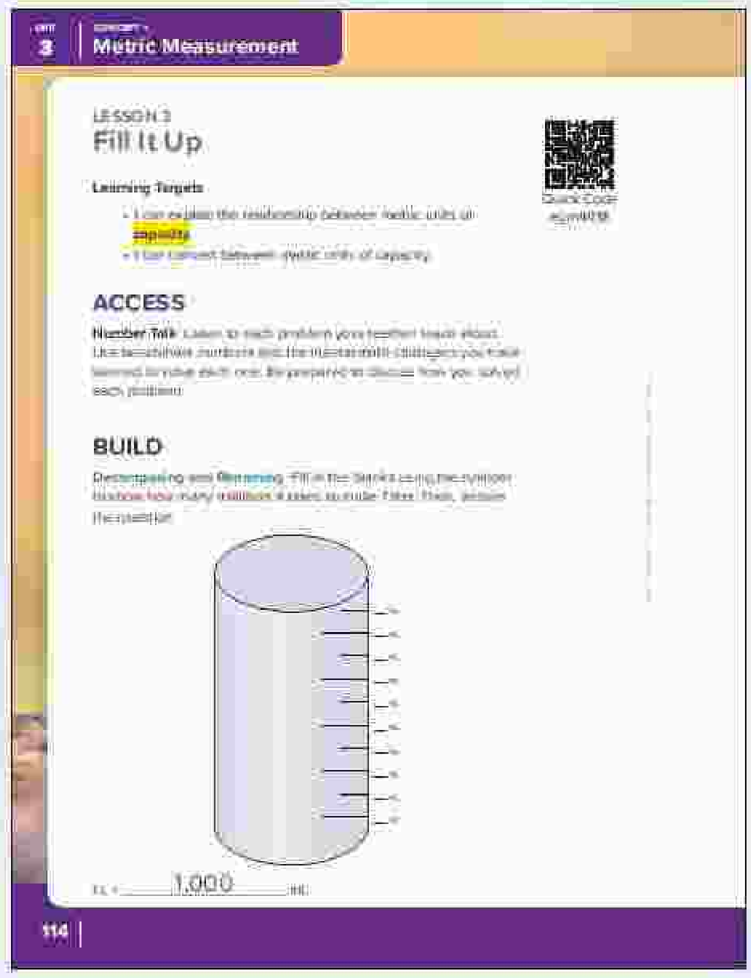
- Students may struggle to remember conversions for metric units of capacity.
- Students may struggle with story problems that require converting to the same units before solving.
- Students often confuse the units of measurement with what is being measured (length, mass, volume).
- Students may compare or try to convert numbers without considering the units of measurement.

Number Talk

1. Explain to students that today they will use benchmark numbers to help them solve multiplication problems.
2. Number Talk directions:
   - Write a problem on the board.
   - Students think quietly and give a Thumbs-Up when they know the answer.
   - Give Wait Time so that all students have enough time to think about the problem.
   - Call on several students who have their Thumbs-Up and record their answers on the board.
   - Ask students to raise their hands to volunteer to explain their thinking.
   - Record students' thinking on the board so other students can see their strategies.
3. Work through as many of the following problems as you can, in sequence:
   - 2 × 20; 4 × 20; 6 × 20
   - 7 × 5; 7 × 10; 7 × 9
   - 2 × 40; 4 × 20; 2 × 50; 4 × 50
   - 2 × 50; 4 × 50; 8 × 50
   - 5 × 5; 5 × 10; 5 × 20; 5 × 19

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UNIT 3 | Metric Measurement

LESSON 3
Fill It Up

Learning Targets

ACCESS

Number Talk

BUILD

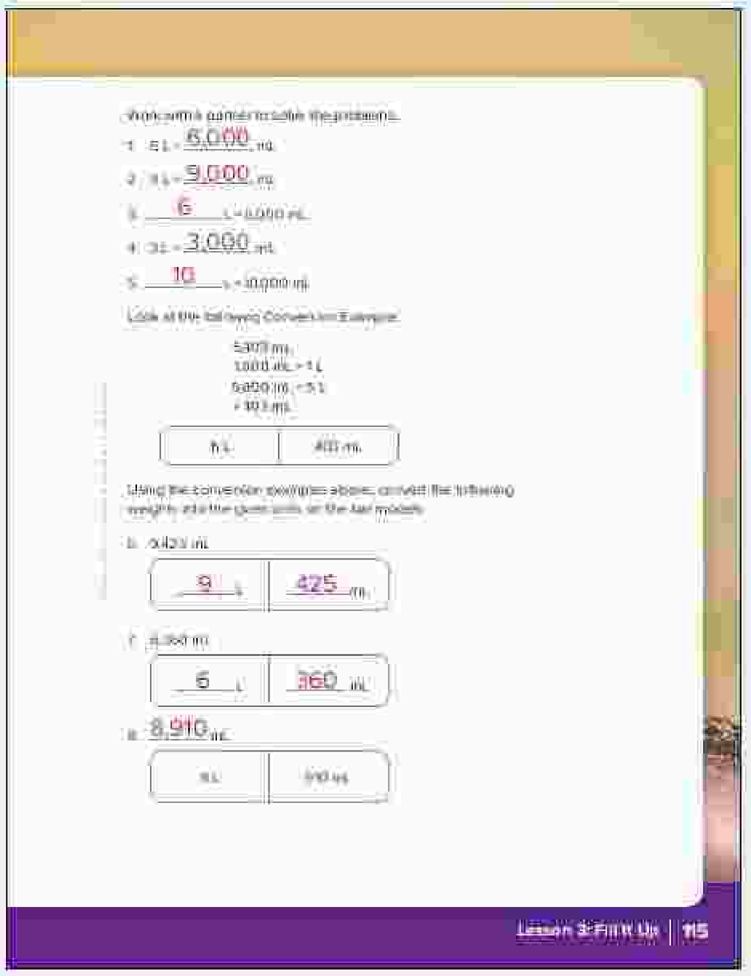
1 L = 1,000 mL

114

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Student Page 115


Work with a partner to solve the problems.

1. 6 L = 6,000 mL
2. 9 L = 9,000 mL
3. 6 L = 6,000 mL
4. 3 L = 3,000 mL
5. 10 L = 10,000 mL

Look at the following Conversion Example:

5,400 mL
1,000 mL = 1 L
5,000 mL = 5 L
+ 400 mL

5 L	400 mL

Using the conversion examples above, convert the following weights into the given units on the bar models.

6. 9,425 mL

9 L	425 mL

7. 6,360 mL

6 L	360 mL

8. 8,910 mL

8 L	910 mL

Lesson 3: Fill It Up | 115

TEACHER NOTE This Number Talk can act as a formative assessment to show what students remember about multiplication. Strategies they may use include multiplying the single digit by the number in the Tens place and then add the zero to the end of the product. They may also use the strategy to multiply by a friendly number and then subtract such as in the problem $7 \times 10 = 70$ and $7 \times 9 = 63$ because $70 - 7 = 63$. These problems are arranged so that students can see this relationship.

BUILD (40 min)

Decomposing and Renaming (25 min)

1. Tell students that another form of measurement is capacity, or how much liquid something holds. Explain that people often use the term *volume* as a synonym for capacity, though the terms are a bit different. Volume refers to the space a 3-dimensional object occupies or contains, while capacity is a property of a given container and describes how much it can hold.

2. Show students a liter container and milliliter container. Remind students that "milli-" means one-thousandth. There are 1,000 milliliters in 1 liter, just like there are 1,000 millimeters in 1 meter.

3. Direct students to Lesson 3 BUILD Decomposing and Renaming. As a class, fill in the scale of the cylinder. Model on the classroom chart how to measure from the base of the cylinder to the first line. Ask students to count the number of lines on the cylinder and ask them what the labels should be.

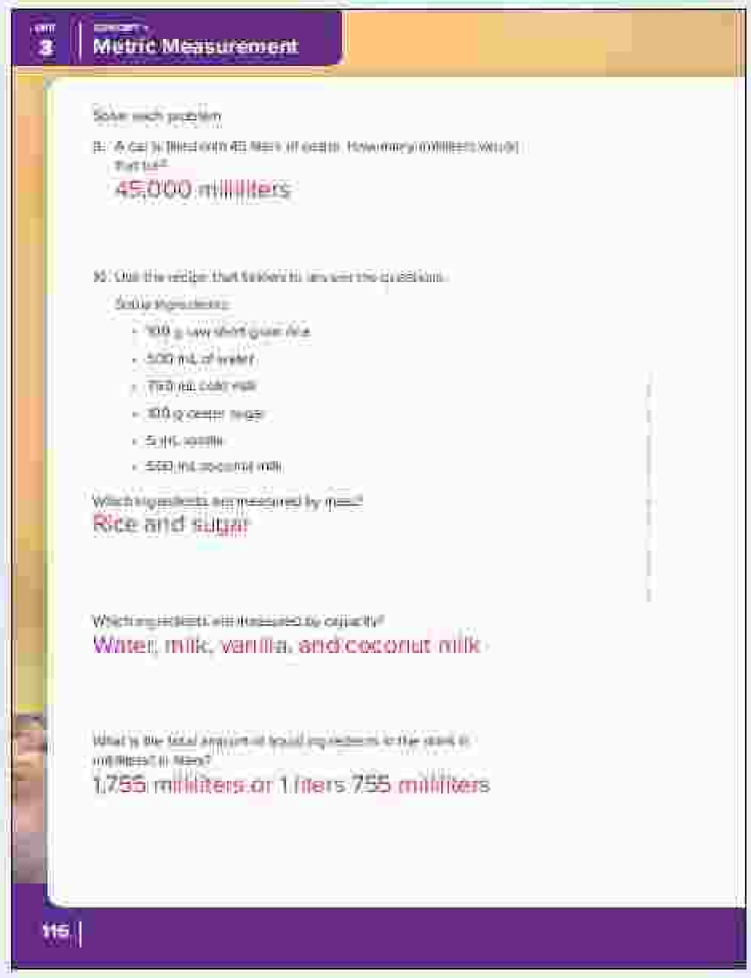
   TEACHER NOTE In this case, the markings on the cylinder count by 100s, starting with 100 at the bottom of the cylinder. This can serve as a formative assessment to see if students remember that measurements can be scaled.

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4. Ask students to work with a partner to solve Problems 1–5. After a few minutes, go over the answers together. Ask students how the conversion from milliliters to liters is similar to other measurement conversions they have learned.
5. Ask students to complete Problems 6–10 with their partner. If students are struggling, regroup the whole class and solve the problems together.
6. After a few minutes, go over the answers together. Encourage students to ask questions to help them clear up misconceptions and correct errors.

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3 | Metric Measurement

Solve each problem.

9. [illegible]

45,000 milliliters

10. [illegible]

- 500 mL of water
- [illegible]
- [illegible]
- 5 mL vanilla
- [illegible]

Which ingredients are measured by mass?

Rice and sugar

Which ingredients are measured by capacity?

Water, milk, vanilla, and coconut milk

[illegible]

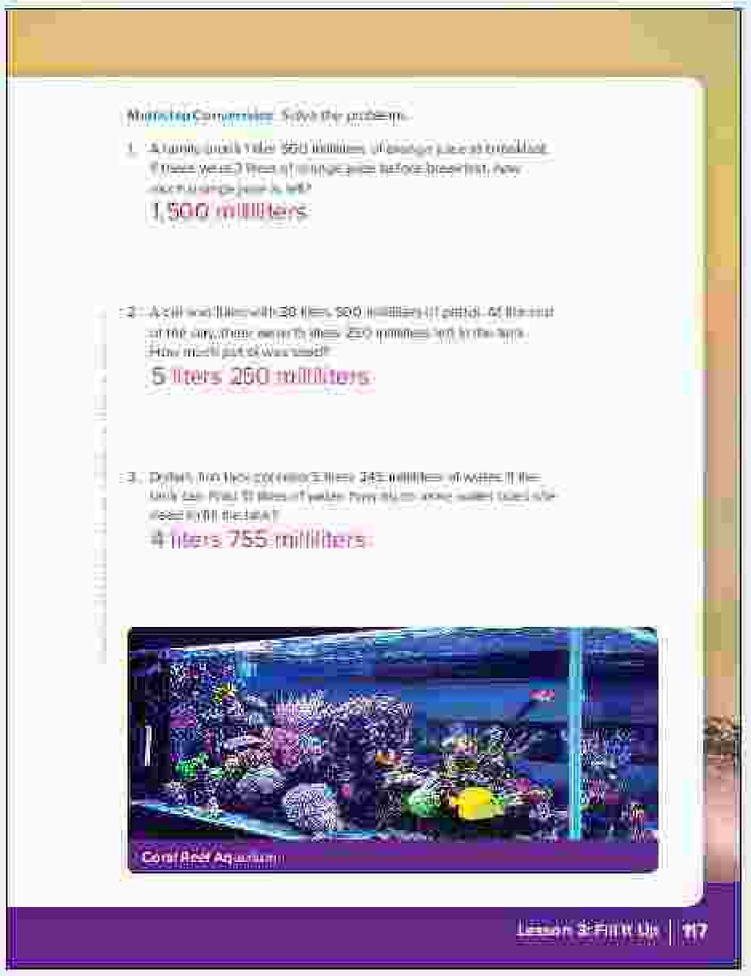
1,755 milliliters or 1 liters 755 milliliters

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Student Page 117


Multistep Conversions Solve the problems.

1. 1,500 milliliters

2. 5 liters 250 milliliters

3. 4 liters 755 milliliters

Coral Reef Aquarium

Lesson 3: Fill It Up | 117

Multistep Conversions (15 min)

1. Ask students to turn to Lesson 3 BUILD Multistep Conversions and read Problem 1 silently.
2. Ask students to talk to their Shoulder Partner about how they might solve the problem. After a minute, call on students to share their thinking with the class. Discuss students' strategies and ask questions to help guide their thinking.
3. Reinforce that students must convert all relevant measurements to the same unit. In this case, they must convert 1 liter 500 milliliters to 1,500 milliliters and 3 liters to 3,000 before they try to subtract.
4. If necessary, model how to use a bar model to help solve the problem.
   - 1 L 500 mL = 1,500 mL



   - 3,000 mL − 1,500 mL = 1,500 mL

5. Consider students' current progress and decide how students will work to solve Problems 2 and 3. They can work with you as a whole group, work with a partner, or you can split the classroom and have some students work independently or with a partner while the remaining students work with you.
6. Use the last 3 minutes of BUILD to go over the answers as a class and to clear up any misconceptions.

CONNECT (7 min)

Math Language Review

1. Direct students to Lesson 3 CONNECT Math Language Review.
2. Ask students to work with their Shoulder Partner to fill in the Measurement Terms chart.
3. Ask students to help you complete your large copy of the Measurement Terms anchor chart and display in the classroom.

   TEACHER NOTE: This is a check to see if students are able to categorize the measurement terms used so far. Often, students confuse units with what is measured, so this chart is helpful as a reference tool. Students may include the unit measurements (meter, gram, liter), or all terms (kilometer, hectometer, decameter, meter, and so on). You may decide to just use the common units (kilometer, meter, centimeter, millimeter, kilogram, gram, and so on). Time will be taught in subsequent lessons but can be filled out in this lesson since students have familiarity from Primary 2 and 3.

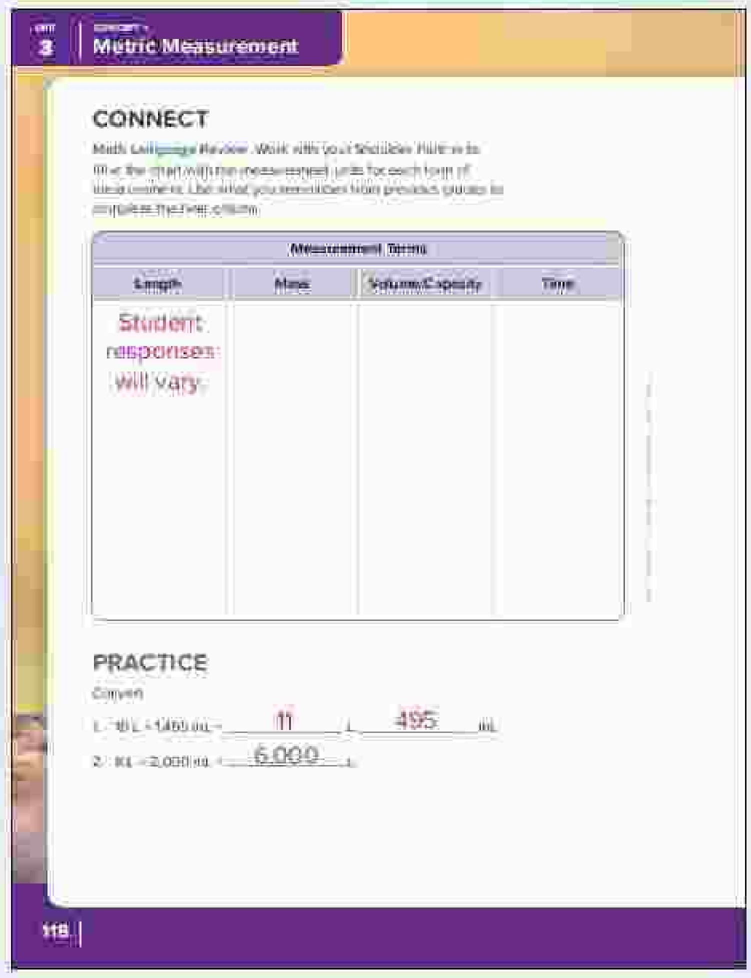
WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to explain to their Shoulder Partner why the size, length, mass, and volume of an object remain the same when converted to another unit of measurement.
2. After a minute, ask students to share their ideas with the whole group.

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3 | Metric Measurement

CONNECT

Measurement Terms			
Length	Mass	Volume/Capacity	Time
Student responses will vary.			

PRACTICE

Convert.

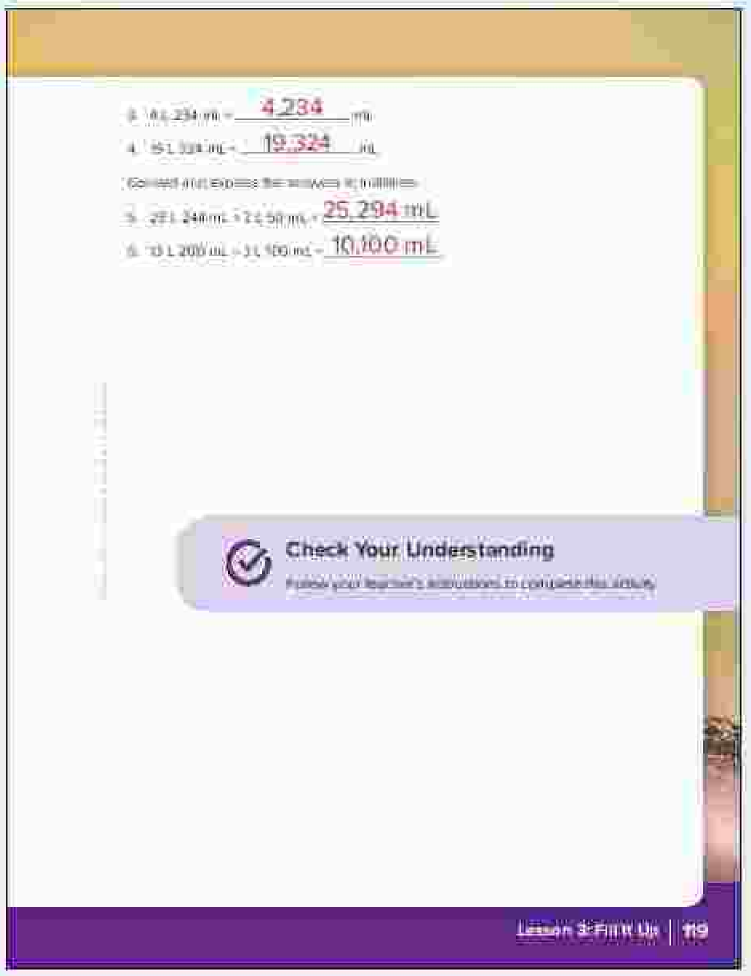
1. 11 L 495 mL
2. 6,000 L

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PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Express the answers in milliliters.

1. 21 L + 2 L 800 mL = 23,800 mL
2. 4 L 485 mL − 323 mL = 4,162 mL

Convert.

3. 11 L 342 mL = 11,342 mL
4. 16,783 mL = 16 L 783 mL

LESSON 4
Measurement and Unit Conversions

Lesson Overview

In this lesson, students synthesize their understanding about metric conversion and explore connections to the place value system. Students use the Metric Conversion chart, introduced at the start of this unit, to convert between metric units and to solve real-world problems.

Lesson Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will compare place value relationships and measurement conversions.
- Students will use multiplication and division to convert units of measurement.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Metric Conversion chart (From Lesson 1)

Preparation

No additional preparation needed

DIGITAL



Lesson 4
Measurement and Unit Conversions

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Unit 3 | Concept 1 Metric Measurement

LESSON 4

Measurement and Unit Conversions

Learning Targets

ACCESS

Water Bottle

A water bottle holds 1 L 500 mL of water.
You drink 750 mL of the water.
How much water is left?

Student's answer: 1 L 250 mL

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- When converting units, students often divide instead of multiplying and vice versa.

Error Analysis

1. Direct students to Lesson 4 ACCESS Error Analysis and ask them to complete the error analysis.
2. Review the answers as a class. The student did not convert 1 liter 500 milliliters to milliliters. The student also subtracted incorrectly, subtracting 500 milliliters from 750 milliliters. The correct answer is 750 milliliters.

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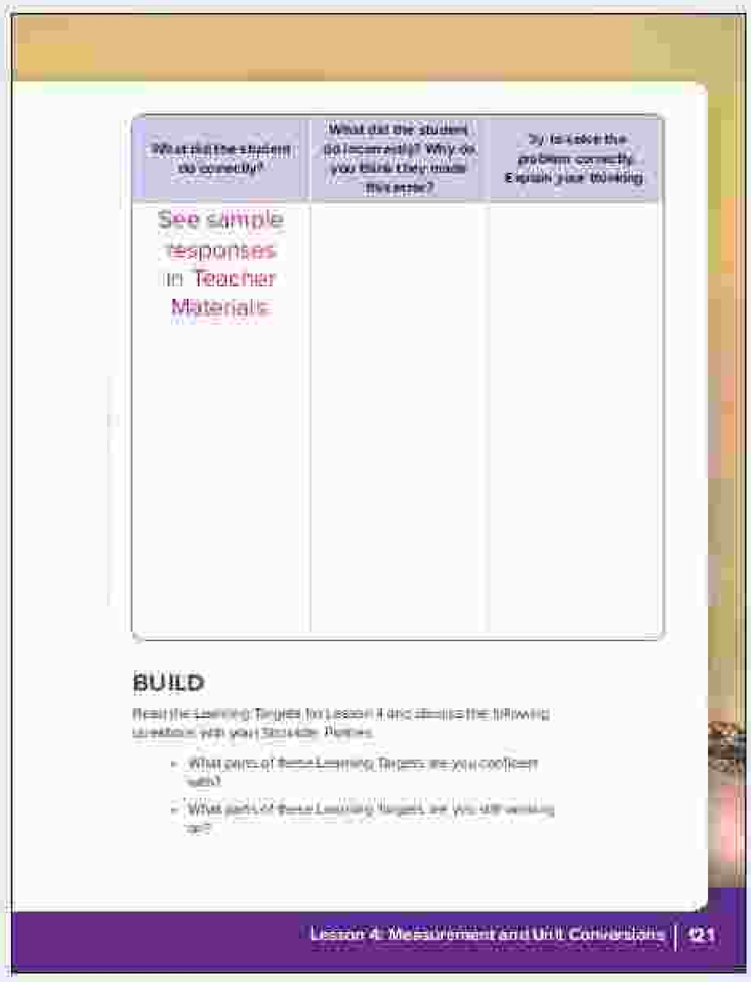
BUILD (40 min)

Chart Connections (15 min)

1. Direct students to the Lesson 4 Learning Targets in their Student Edition. Ask students to read the Learning Targets and discuss the following questions with their Shoulder Partner:
   - *What parts of these Learning Targets are you confident with?*
   - *What parts of these Learning Targets are you still working on?*
2. Direct students' attention to BUILD Chart Connections in their Student Edition. Review the Metric Conversion chart with students. Ask questions to promote students' thinking, such as:
   - *What do you notice about this chart?*
   - *How is it similar to a Place Value chart?*
   - *How is it different from a Place Value chart?*
3. Use Calling Sticks to choose a few students to share what they notice.
   Students should recognize that the values change by 10 times, increasing or decreasing as they move to the left or right on the chart.
4. Explain the following:
   - On a place value chart, we multiply by 10 when we move to the left and the numbers become larger. (For example, when we move a 2 from the Ones to the Tens it becomes 20, and when we move it to the Hundreds it becomes 200.)
   - In the metric system when we move to the left the digits become smaller. 2,000 meters becomes 200 decameters, 20 hectometers, and 2 kilometers.
   - That is because in a place value chart the value of the digit is changing which means the value changes. However, in the metric system the value stays the same. All of the measurements are equivalent.
5. Ask students to work with a partner to fill in the remainder of the boxes in the Metric Conversion chart and to complete Problems 1 and 2. The meter row has been completed as an example. After a few minutes, go over the answers together.

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What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.
See sample responses in Teacher Materials		

BUILD

Read the Learning Targets for Lesson 4 and discuss the following questions with your Shoulder Partner.

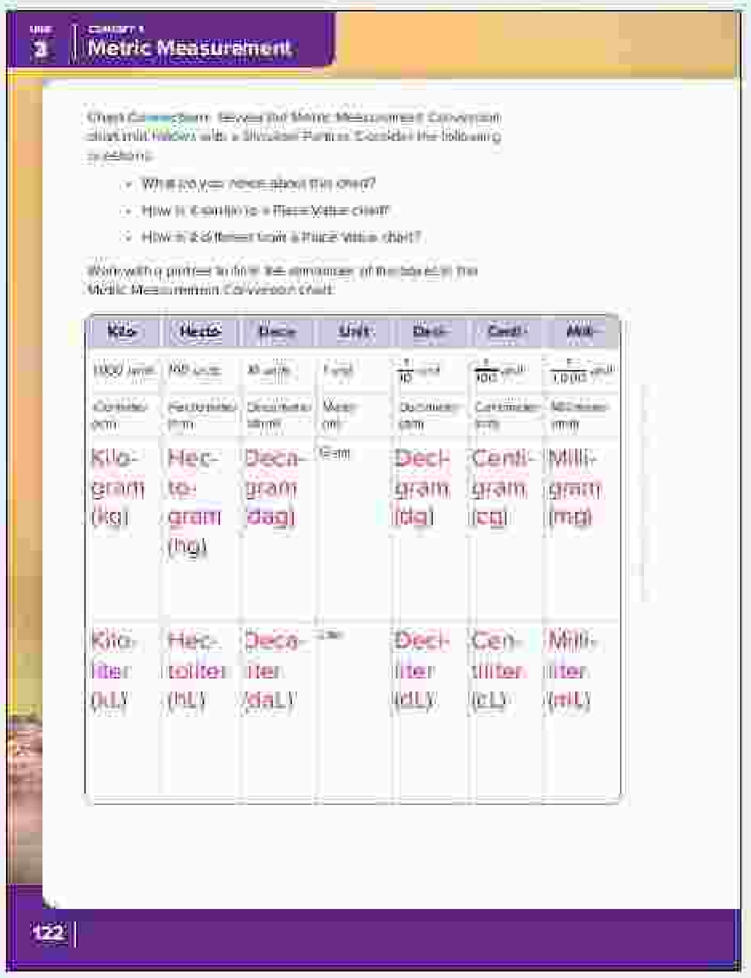
- What parts of these Learning Targets are you confident with?
- What parts of these Learning Targets are you still working on?

Lesson 4: Measurement and Unit Conversions | 121

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Student Page 122


3 | Metric Measurement

Kilo-	Hecto-	Deca-	Unit	Deci-	Centi-	Milli-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kilogram (kg)	Hectogram (hg)	Decagram (dag)	Gram	Decigram (dg)	Centigram (cg)	Milligram (mg)
Kiloliter (kL)	Hectoliter (hL)	Decaliter (daL)	Liter	Deciliter (dL)	Centiliter (cL)	Milliliter (mL)

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6. After students are finished, use Calling Sticks to ask students to share what they notice.

More Conversions (25 min)

1. Ask students what operation they used to convert from larger units, like kilograms, to smaller units, like grams. (Multiplication)
2. Reinforce this by writing the following on the board:

$$5 \text{ kg} = _____ \text{ g}$$
$$5 \text{ kg} \times 1{,}000 = ______ \text{ g}$$

3. Share with the students that we multiply 5 by 1,000 because we know that there are 1,000 grams in 1 kilogram. Notice that it is like the place value chart. As we move to the right 3 spaces, we are moving from a larger unit to a smaller unit, so we multiply by 1,000.
4. Ask students what operation they used to convert from smaller units, like centimeters to larger units, like meters. (Division)
5. Reinforce this by writing the following on the board:

$$500 \text{ cm} = ______ \text{ m}$$
$$500 \text{ cm} \div 100 = ______ \text{ m}$$

6. Share with the students that we divide 500 by 100 since we know that there are 100 centimeters in 1 meter. Notice that it is like the place value chart. As we move to the left 2 spaces, we are moving from a smaller unit to a larger unit, so we divide by 100.
7. Ask students to turn to Lesson 4 BUILD More Conversions and complete Problems 1–7. This can be done independently, with a small group, or as a class, depending on the needs of the students.

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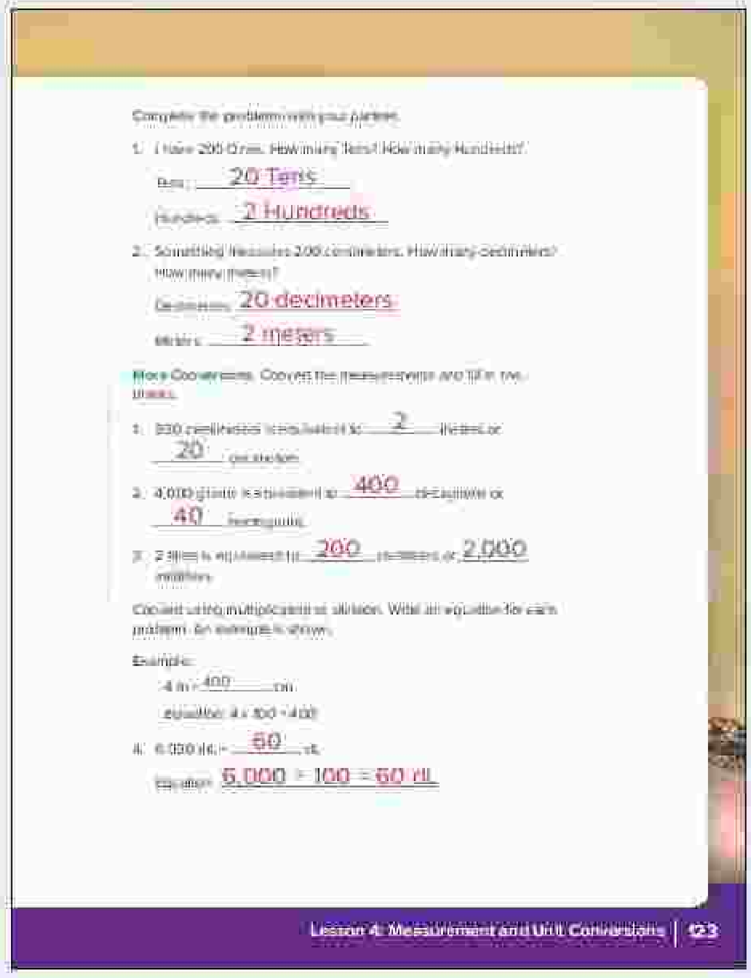
8. In the last 5 minutes of BUILD, review all answers and resolve any lingering misconceptions and errors.

Answer Key for More Conversions:

1. 200 centimeters is equivalent to 2 meters and 20 decimeters
2. 4,000 grams is equivalent to 400 decagrams and 40 hectograms
3. 2 liters is equivalent to 200 centiliters and 2,000 milliliters
4. 6,000 mL = 60 dL; 6,000 ÷ 100 = 60 dL
5. 40 g = 4 dag; 40 ÷ 10 = 4 dag
6. 70 km = 700 hm; 70 × 10 = 700 hm
7. Answers will vary, but students should multiply or divide accurately according to the relationships between the units they choose.

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Student Page 123


Complete the problems with your partner.

1. I have 200 Ones. How many Tens? How many Hundreds?

Tens: 20 Tens

Hundreds: 2 Hundreds

2. Something measures 200 centimeters. How many decimeters? How many meters?

Decimeters: 20 decimeters

Meters: 2 meters

More Conversions: Convert the measurements and fill in the blanks.

1. 200 centimeters is equivalent to 2 meters or 20 decimeters.
2. 4,000 grams is equivalent to 400 decagrams or 40 hectograms.
3. 2 liters is equivalent to 200 centiliters or 2,000 milliliters.

Convert using multiplication or division. Write an equation for each problem. An example is shown.

Example:

4 m = 400 cm

equation: 4 × 100 = 400

4. 6,000 mL = 60 dL

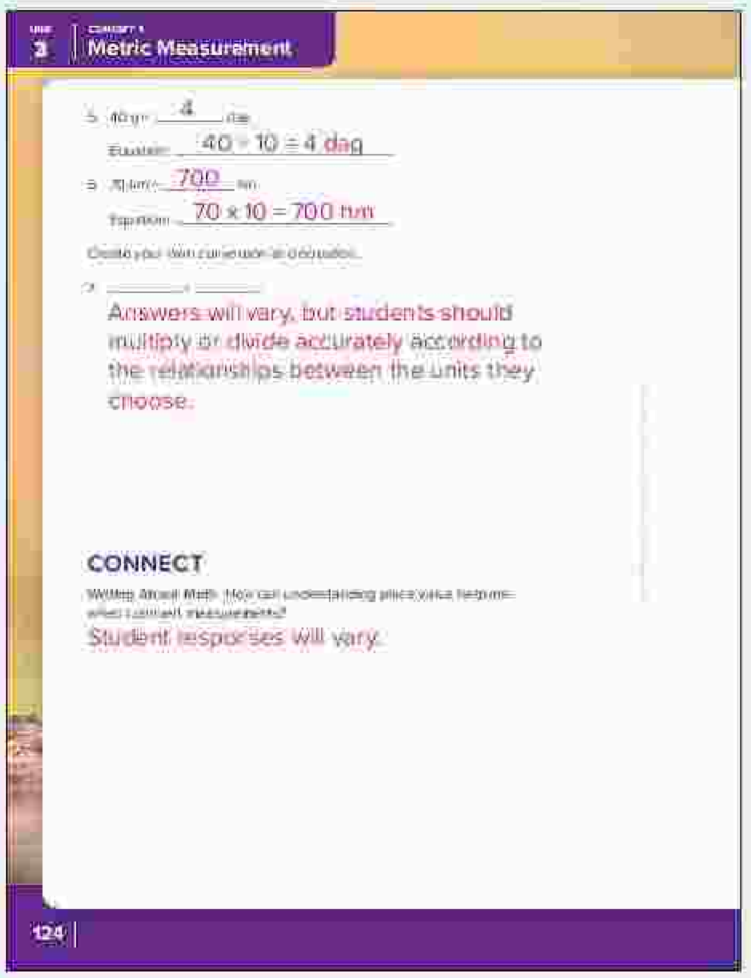
Equation: 6,000 ÷ 100 = 60 dL

Lesson 4: Measurement and Unit Conversions | 123

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Student Page 124


Metric Measurement

40 g = 4 dag

Equation: 40 ÷ 10 = 4 dag

70 hm = 700 hm

Equation: 70 × 10 = 700 hm

Answers will vary, but students should multiply or divide accurately according to the relationships between the units they choose.

CONNECT

Student responses will vary.

124

CONNECT (7 min)

Writing About Math (7 min)

Direct students to Lesson 4 CONNECT Writing About Math and ask them to respond to the prompt.

TEACHER NOTE: Consider using this Writing About Math response as a formative assessment to determine which students may need additional instruction and support.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their ideas with a partner. Allow students the opportunity to revise or add to their original Writing About Math response if needed.

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PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

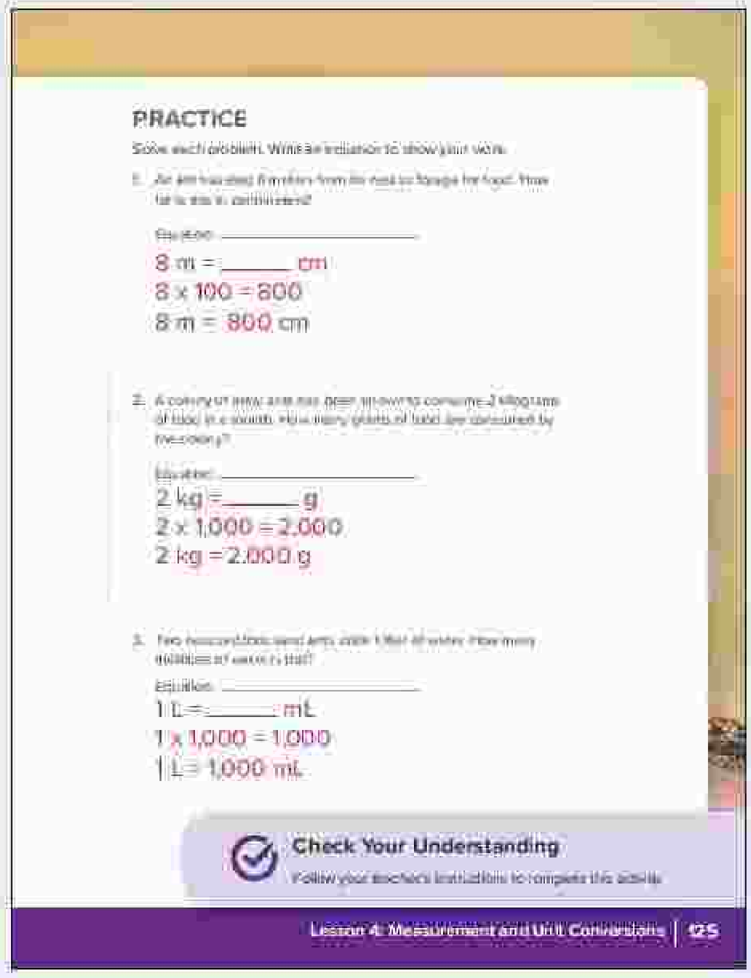
Check Your Understanding

1. Highlight or color in the equivalent measurements. Create at least four more equivalent measurements.

6 m	600 cm	60 dm	60,000 mm
8 kg	800 g	80 hg	80,000 dg
3 L	30 dL	30 cL	3,000 mL
(Create your own)	Responses may vary	Responses may vary	Responses may vary

PRINT

Student Page 125



PRACTICE

Equation: ________

8 m = _____ cm
8 x 100 = 800
8 m = 800 cm

Equation: ________

2 kg = _____ g
2 x 1,000 = 2,000
2 kg = 2,000 g

Equation: ________

1 L = _____ mL
1 x 1,000 = 1,000
1 L = 1,000 mL

Check Your Understanding

Lesson 4: Measurement and Unit Conversions | 125

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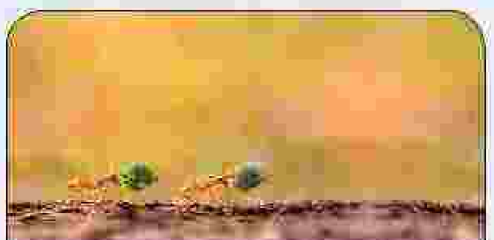
Materials List

- Materials may vary

Preparation

No additional preparation needed

DIGITAL



Concept Check-In and Remediation

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Understand Concepts of Measurement. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How are metric units of measurement related to each other?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to converting measurement units for length, mass, and volume.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve story problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

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Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to remember the conversions for metric units of measurement.
- Students often confuse the units of measurement with what is being measured (length, mass, volume).
- Students may compare or try to convert numbers without considering the units of measurement.
- When converting units, students often divide instead of multiplying and vice versa.

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Remediation: Correcting Misconceptions

If...	Then...
Students struggle to remember and solve the conversions for metric length measurement.	Review Decomposing and Renaming Unit Conversions from Lesson 1. Review the terms with students and continue to work on bar models and conversion tables. Students can also practice measuring items with meter sticks and rulers and visually seeing the difference in the units.
If...	**Then...**
Students struggle to remember and solve the conversions for metric weight measurement.	Review Conversion and Application from Lesson 2. Review the terms with students and continue to work on bar models and conversion tables. Consider using Base Ten blocks to represent the units of measurement so that students can more readily see the relationships between some of the units.
If...	**Then...**
Students struggle to remember and solve the conversions for metric capacity measurement.	Review Decomposing and Renaming from Lesson 3. Review the terms with students and continue to work on bar models and conversion tables.

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<table>
<tr><th>If...</th><th>Then...</th></tr>
<tr><td>Students struggle with story problems that require converting to the same units before solving.</td><td>Review Multistep Conversions from Lesson 3 and create similar problems for students to work on together. Draw bar models for students to use for these problems instead of having them draw them themselves. Consider implementing the following activity:

Materials:
• 1 liter of water
• 2 containers measuring 600 milliliters each
• Markers

1. Ask students:
• If we go from a unit that is smaller to a unit that is larger, what operation will we use? (most will respond multiply)

2. Tell students that to go from liters to milliliters, a larger unit to smaller unit, we multiply. It takes more than 1 milliliter to equal 1 liter. Ask students to explain why we multiply.

TEACHER NOTE: Reinforce that multiplying gets us to larger numbers.

3. Have a student hold up 1 liter of water. Have the student pour the water into the two provided containers (1st container fill to 600 milliliters and the other container will hold the remaining 400 milliliters).

4. Add 600 + 400 = 1000.

TEACHER NOTE: Pouring the water from the larger container to the smaller containers gives a visual of what conversion is.

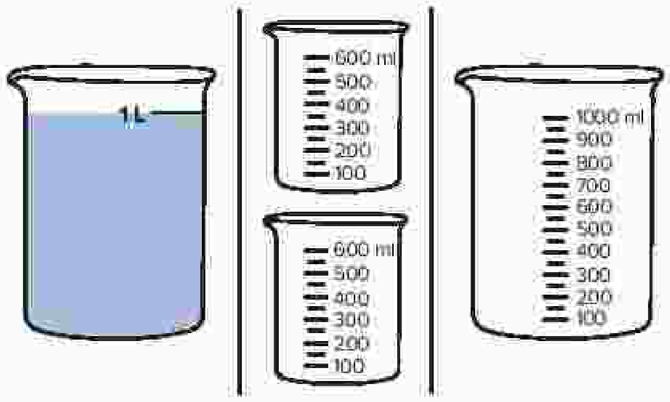
5. Pour the water from the 2 containers back into the 1 liter container. Explain that when going from a smaller unit to a larger unit we divide. (It takes less liters to equal a milliliter.)</td></tr>
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6. Ask students why we divide.

TEACHER NOTE: Reinforce that dividing gets us to smaller numbers.

7. Using the experiment in class, color the containers in the middle to the line showing the amount of milliliters. In the last column, color the container to show where the water filled to when pouring it back.



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<tr>
<td>If...

Students divide instead of multiplying and vice versa to solve conversion problems.</td>
<td>Then...

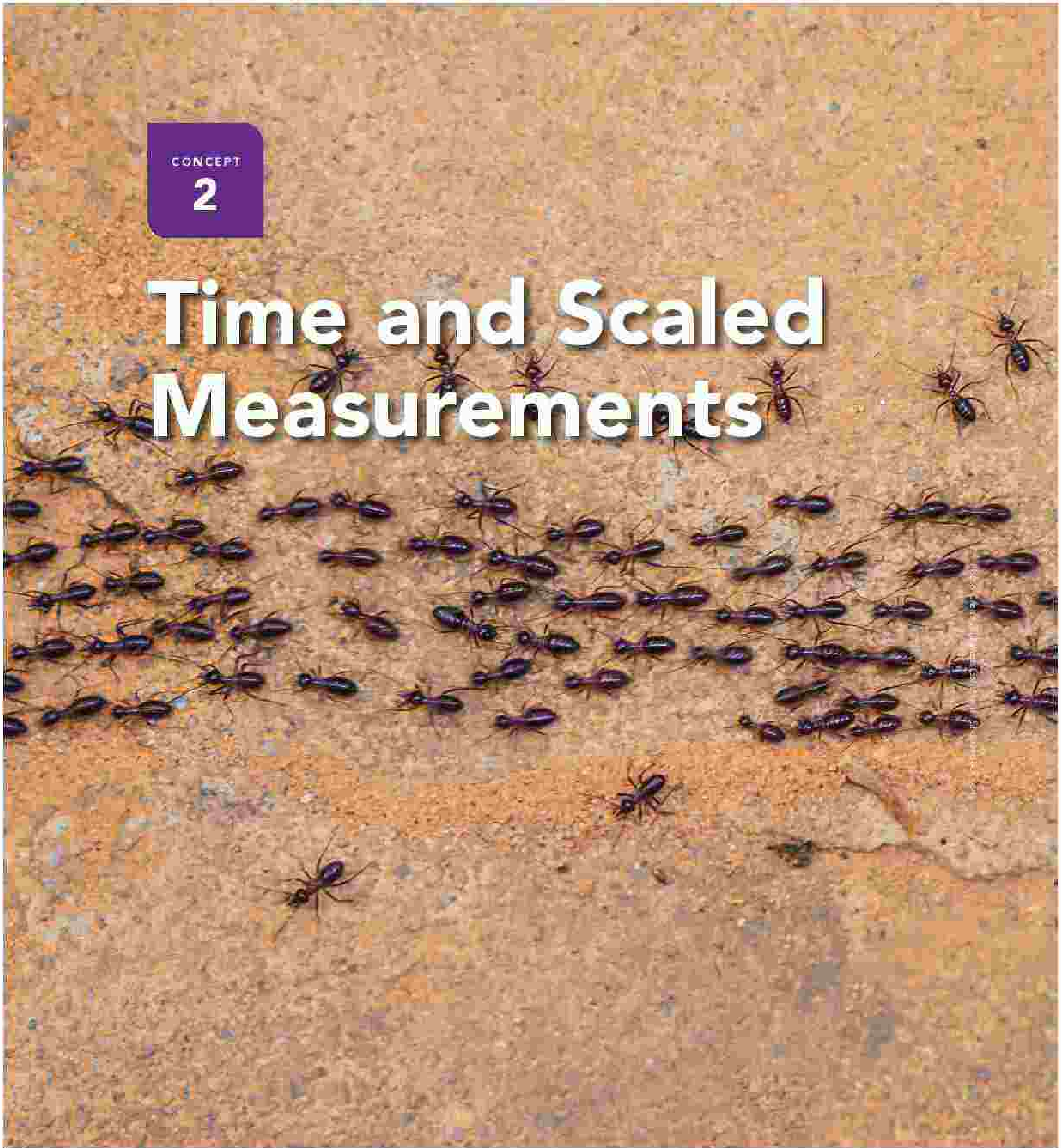
Review Chart Connections from Lesson 4 and choose measurements for students to practice writing in multiple form.

TEACHER NOTE: Emphasize that when changing to smaller units you multiply, and when changing to larger units you divide.</td>
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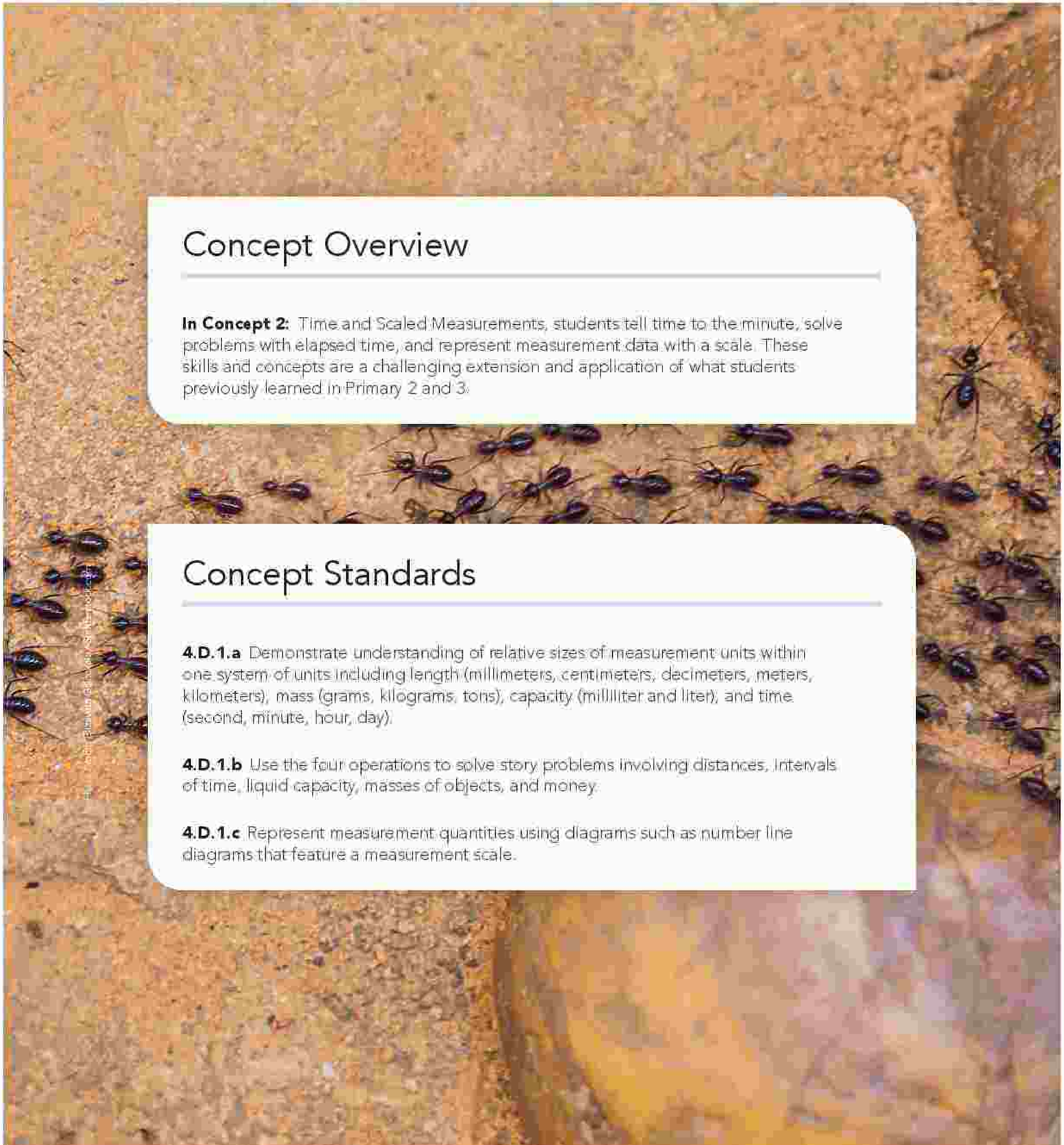
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CONCEPT
2

Time and Scaled Measurements



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Concept Overview

In Concept 2: Time and Scaled Measurements, students tell time to the minute, solve problems with elapsed time, and represent measurement data with a scale. These skills and concepts are a challenging extension and application of what students previously learned in Primary 2 and 3.

Concept Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve story problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

4.D.1.c Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Concept Planner

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
5 What Time Is It?	• Red and blue crayons or colored pencils (1 each per student) • Analog clock with hour, minute, and second hands • Ratio tables • Measurement anchor chart	Analog Decade Digital Elapsed Ratio Table	• Students will tell time to the minute. • Students will explain relationships between units of time.	
6 How Long Does It Take?	• Problem Solving Strategy anchor chart Create and display a Steps to Solving Story Problems anchor chart: Steps to Solving Story Problems 1. Circle important numbers and labels. 2. Underline questions. 3. Draw a box around operation clues. 4. Examine the information: • What is known? • What is unknown? • What is the hidden question? 5. Use what is known to answer the hidden question. 6. Use the new information to solve the problem and find the unknown.	Conversion Elapsed time Open number line	• Students will explain elapsed time. • Students will solve elapsed time problems. • Students will explain the strategies they use to solve elapsed time problems.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may struggle to read time on an analog clock. They may confuse the hour and the minute hands or think that the digits on the clock are in 5-minute intervals. • Students may struggle to remember the conversions for time, such as how many seconds in a minute, minutes in an hour, hours in a day, days in a week, and so on.	Ratio Tables, How Hard Do Ants Work, Practice, Check Your Understanding
	• Students may struggle to calculate elapsed time that requires them to regroup hours and minutes or minutes and seconds. • Students may be unsure how to write equations with time. • Students may not have effective strategies for converting time intervals and solving elapsed time problems. • Students often confuse regrouping in elapsed time problems with regrouping in the Base Ten number system.	Error Analysis, Solving Elapsed Time Problems, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
7 Scaled Measurements	• Lesson 7 Image: Largest Fossilized Ant (Located at end of volume)	Line plot Scale	• Students will create line plots to represent given data. • Students will select an appropriate key and scale for a line plot. • Students will write questions that can be answered by their line plots.	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to time and scaled number lines.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not understand how to represent data on a line plot. • Students may not be sure what each X represents on a line plot. • Students may incorrectly label the scale of a line plot or choose a key or scale that is not appropriate for the data.	Fun With Facts, Length of Ants, Scales Everywhere We Look, Practice, Check Your Understanding
	• Students may struggle to read time on an analog clock. They may confuse the hour and the minute hands or think that the digits on the clock are in 5-minute intervals. • Students may struggle to remember the conversions for time: how many seconds in a minute, minutes in an hour, hours in a day, days in a week. • Students may not have effective strategies to convert time intervals and solve elapsed time problems. • Students may not understand how to represent data on a line plot. • Students may incorrectly label the scale of a line plot or choose a key or scale that is not appropriate for the data.	

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LESSON 5
What Time Is It?

Lesson Overview

In this lesson, students review telling time on an analog clock. Then, they look at the units involved in telling time and use ratio tables to compare seconds to minutes, minutes to hours, hours to days, and days to weeks. Students use these ratio tables to help them complete conversion problems and apply their knowledge to solve time conversion story problems.

Essential Questions

- What are the relationships among units of time?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will tell time to the minute.
- Students will explain relationships between units of time.

Grade-Level Standard

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

Vocabulary Check-In

analog, decade, digital, elapsed, ratio table

Materials List

- Red and blue crayons or colored pencils (1 each per student)
- Analog clock with hour, minute, and second hands
- Ratio tables
- Measurement anchor chart

Preparation

No additional preparation needed

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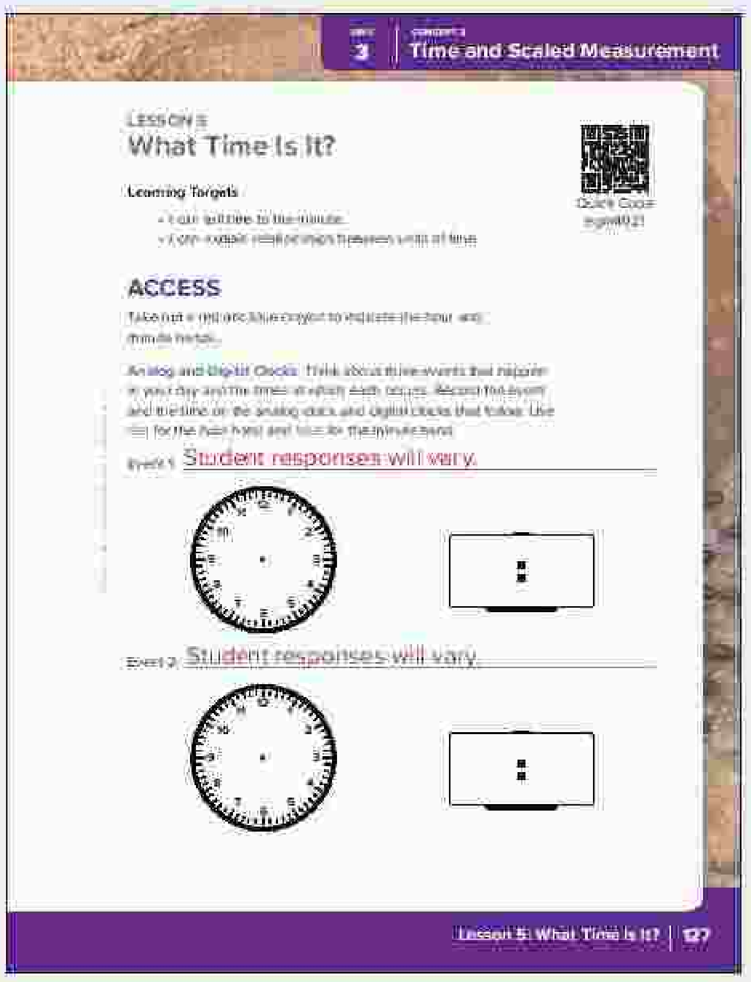


Lesson 5
What Time Is It?

Quick Code: egmt4021

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3

Time and Scaled Measurement

LESSON 5

What Time Is It?

Learning Targets

- I can tell time to the minute.
- I can explain relationships between units of time.

Quick Code

ACCESS

Take out a red and blue crayon to indicate the hour and minute hands.

Analog and Digital Clocks Think about three events that happen in your day and the times at which each occurs. Record the event and the time on the analog clock and digital clocks that follow. Use red for the hour hand and blue for the minute hand.

Event 1: Student responses will vary.

Event 2: Student responses will vary.

Lesson 5: What Time Is It? | 127

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to read time on an analog clock. They may confuse the hour and the minute hands or think that the digits on the clock are in 5-minute intervals.
- Students may struggle to remember the conversions for time, such as how many seconds in a minute, minutes in an hour, hours in a day, days in a week, and so on.

Analog and Digital Clocks

1. Distribute (or have students take out) a red and blue crayon or colored pencils to indicate the hour and minute hands.
2. Direct students to work on Lesson 5 ACCESS Analog and Digital Clocks. Ask students to record three events and the times they occur.
3. Use Calling Sticks to select 4–5 students to share their events and record on the board the time in digital and analog formats.
4. Pose the following questions to the group and discuss:
    - *Why do we need to tell time?*
    - *Why is time considered a measurement?*

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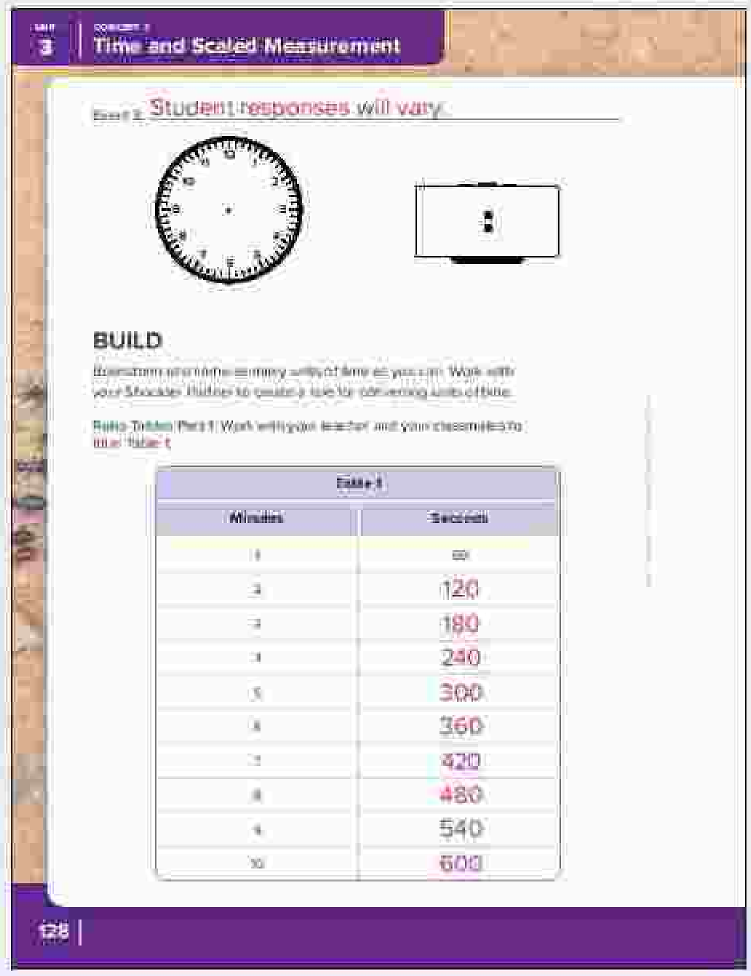
BUILD (40 min)

Ratio Tables Part 1 (20 min)

1. Ask students to chorally read today's Learning Targets. Remind students that they worked on telling time quite a bit in Primary 3 but this year the focus is on the relationship between units of time.
2. Hold up an analog clock and point to the three hands. Ask students:
   - *What units do these three hands represent?* (Hours, minutes, and seconds)
   - *How many seconds are in a minute?* (60)
   - *How many minutes are in an hour?* (60)
3. Ask students to brainstorm and name as many units of time as they can. Record their answers on the board and add missing units if needed (seconds, minutes, hours, days, weeks, years, and decades).
4. Direct students to work with their Shoulder Partner to create a rule for converting minutes to seconds. Ask students to share their ideas.
5. Ask students to discuss: Are their rules the same rules they use to convert metric measurements? Why or why not?

PRINT

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UNIT 3 | CONCEPT 2
Time and Scaled Measurement

Student responses will vary.

BUILD

Brainstorm and name as many units of time as you can. Work with your Shoulder Partner to create a rule for converting units of time.

Ratio Tables Part 1: Work with your teacher and your classmates to fill in Table 1.

Table 1	
Minutes	Seconds
1	60
2	120
3	180
4	240
5	300
6	360
7	420
8	480
9	540
10	600

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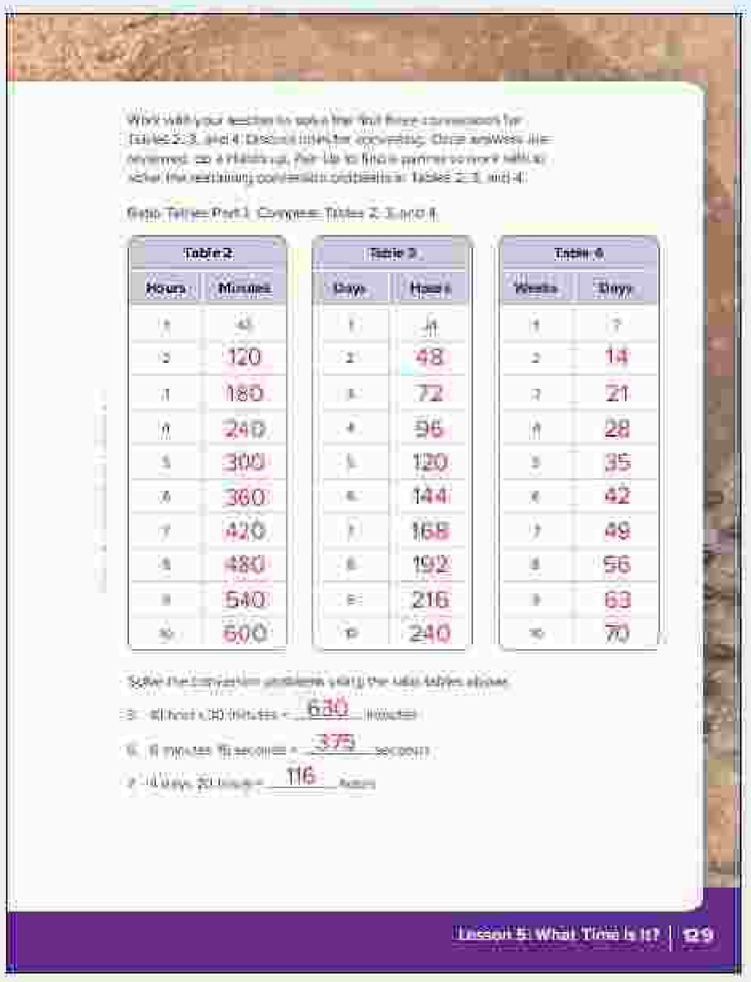


Table 2	
Hours	Minutes
1	[illegible]
2	120
3	180
4	240
5	300
6	360
7	420
8	480
9	540
10	600

Table 3	
Days	Hours
1	[illegible]
2	48
3	72
4	96
5	120
6	144
7	168
8	192
9	216
10	240

Table 4	
Weeks	Days
1	7
2	14
3	21
4	28
5	35
6	42
7	49
8	56
9	63
10	70

630

375

116

Lesson 5: What Time Is It? | 129

6. Ask students to open their Student Edition to LESSON 5 BUILD Ratio Tables Part 1.
7. Explain that a ratio table shows the comparison of two or more numbers in relation to each other. This ratio table shows the relationship between minutes and seconds.
8. Draw a copy of Table 1 on the board. Ask students to help you fill out the Table 1 as they fill out the table in in their Student Editions.

Minutes	Seconds
1	60
2	120
3	180
4	240
5	300
6	360
7	420
8	480
9	540
10	600

9. Ask students to Turn and Talk about how they could use the table to solve how many seconds are in 15 minutes? 30 minutes?

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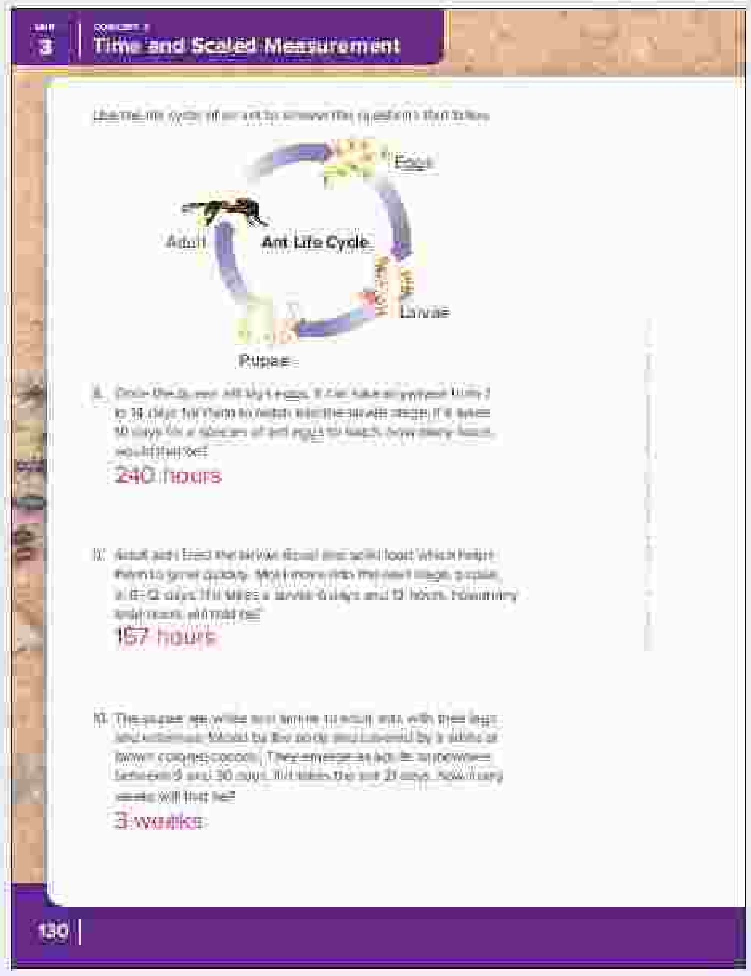
10. Use Calling Sticks to call on 2–3 students to share their ideas, then ask:
    - *Could a similar ratio table be made to convert hours to minutes? Days to hours?*

Ratio Tables Part 2 (20 min)

11. Work with students to solve the first three conversions for Tables 2, 3, and 4 in Ratio Tables Part 2. Discuss rules for converting. For example, to convert hours to minutes, multiply the number of hours by 60 minutes.
12. Tell students to Hands Up, Pair Up to find a partner to work with to solve the remaining conversion problems in Tables 2, 3, and 4 and Problems 5–10.
13. When there are a few minutes left in BUILD, review the answers, and resolve any misconceptions and errors.

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3 | Time and Scaled Measurement

8. 240 hours

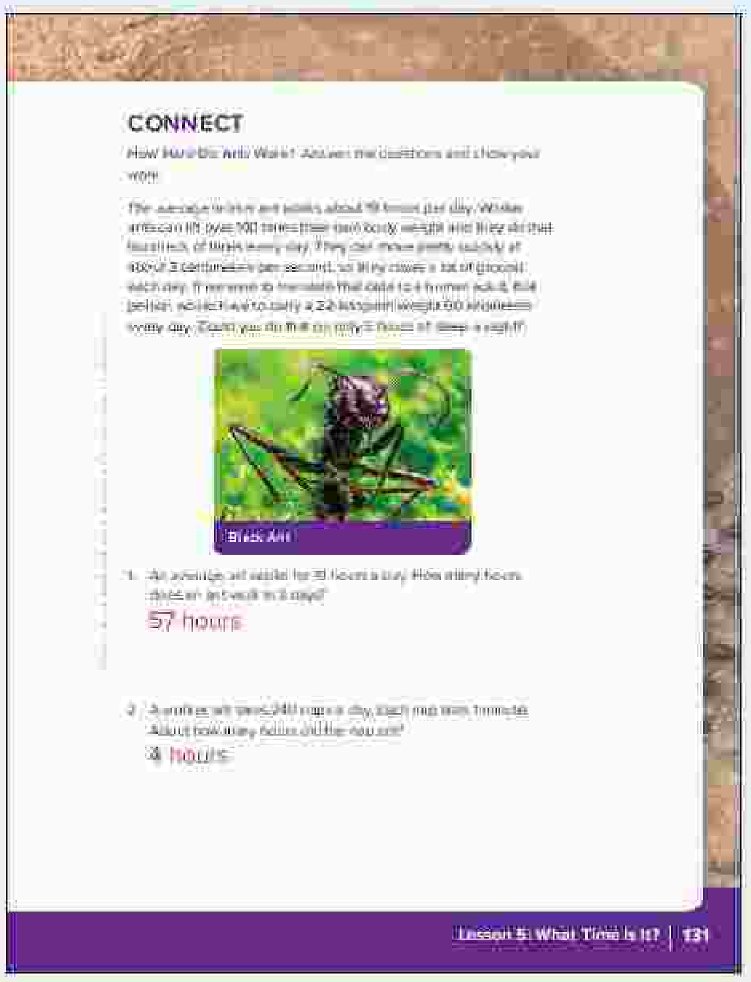
9. 157 hours

10. 3 weeks

130

PRINT

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CONNECT

How Hard Do Ants Work? [illegible]

[illegible]

Black Ant

1. [illegible]

57 hours

2. [illegible]

4 hours

Lesson 5: What Time Is It? | 131

CONNECT (7 min)

How Hard Do Ants Work?

1. Ask students to turn to LESSON 5 CONNECT How Hard Do Ants Work? Ask volunteers to read the paragraph aloud.
2. Discuss the fact that the average worker ant works 19 hours a day.
   - *How many hours a day do you estimate you work at school and at home?*
   - *How many hours a day do you estimate your parents or caregivers work in a day?*
3. Ask students to use the information in the paragraph to answer the questions.

TEACHER NOTE: Consider using this activity as a formative assessment to determine which students might need additional instruction and practice.

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WRAP-UP (3 min)

Let's Chat About Our Learning

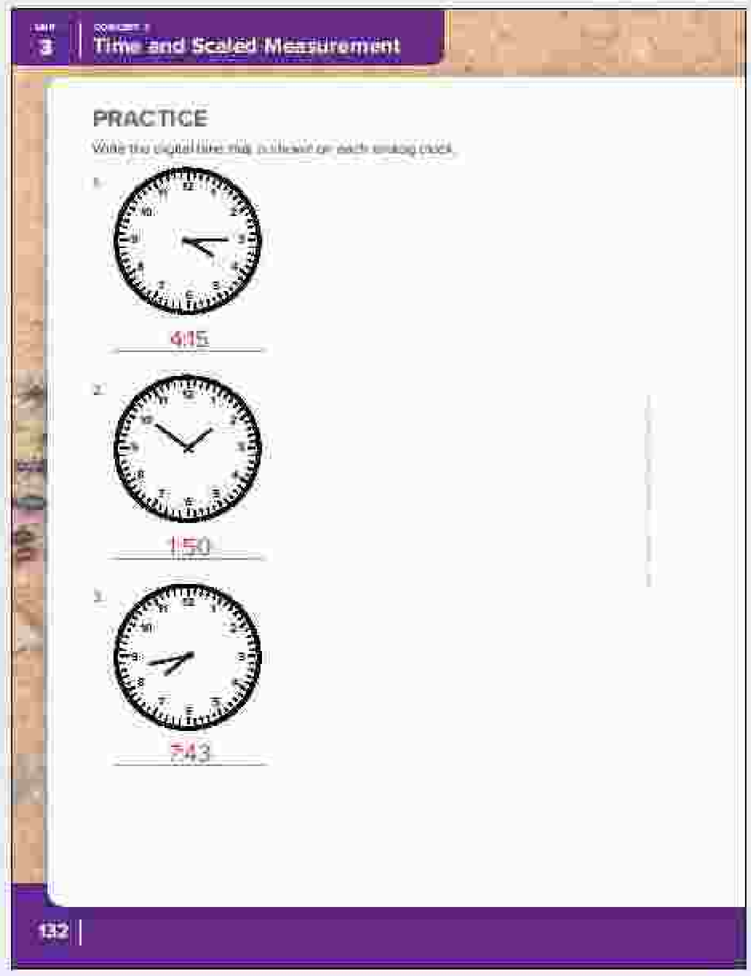
1. Ask volunteers to share the strategies and operations they used to solve the problems.

PRACTICE

Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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3 | Time and Scaled Measurement

PRACTICE

1. 4:15

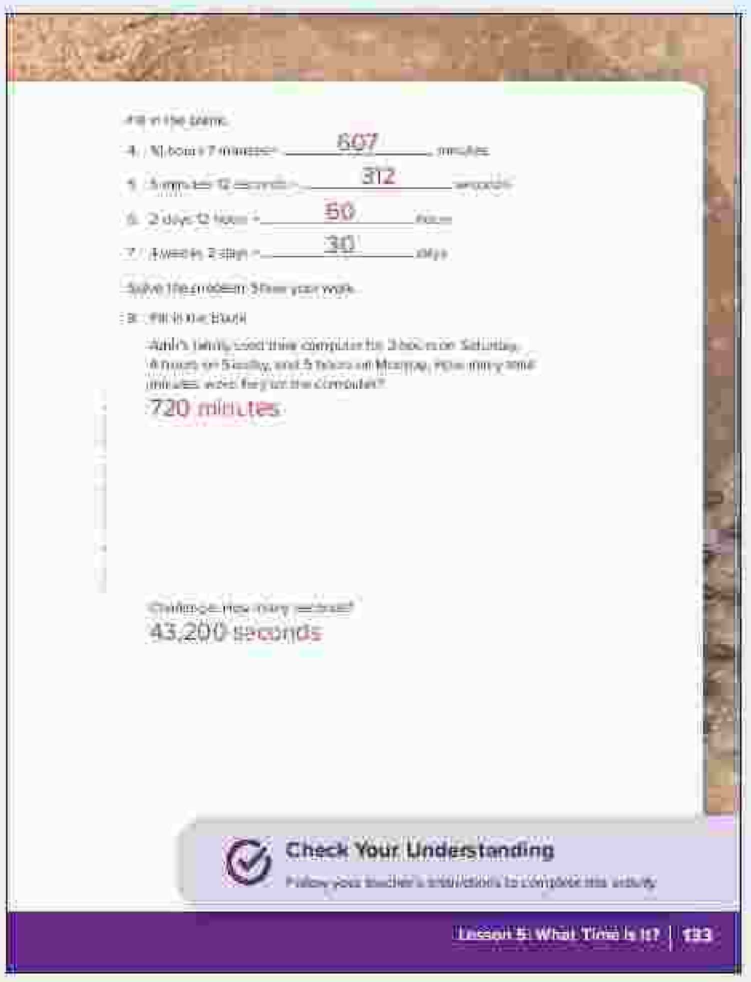
2. 1:50

3. 7:43

132

PRINT

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Check Your Understanding

Write the time for each clock.

1. 3:50
2. 4:20

Fill in the blanks.

3. 5 hours 10 minutes = 310 minutes
4. 4 minutes 11 seconds = 251 seconds
5. 3 days 10 hours = 82 hours
6. 2 weeks 2 days = 16 days
7. 5 + 2 = 7; 7 × 60 = 420 minutes

Challenge: 420 × 60 = 2,520 seconds

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LESSON 6
How Long Does It Take?

Lesson Overview

In this lesson, students explore the concept of elapsed time in bare number problems as well as story problems. Students apply what they learned about converting units of time and explore different strategies to model and solve problems involving elapsed time.

Essential Questions

- What are the relationships between units of time?
- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will explain elapsed time.
- Students will solve elapsed time problems.
- Students will explain the strategies they use to solve elapsed time problems.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

conversion, elapsed time, open number line

Materials List

- Problem Solving Strategy anchor chart

Preparation

Create and display a Steps to Solving Story Problems anchor chart:

Steps to Solving Story Problems

1. Circle important numbers and labels.
2. Underline questions.
3. Draw a box around operation cues.
4. Examine the information:
   - What is known?
   - What is unknown?
   - What is the hidden question?
5. Use what is known to answer the hidden question.
6. Use the new information to solve the problem and find the unknown.

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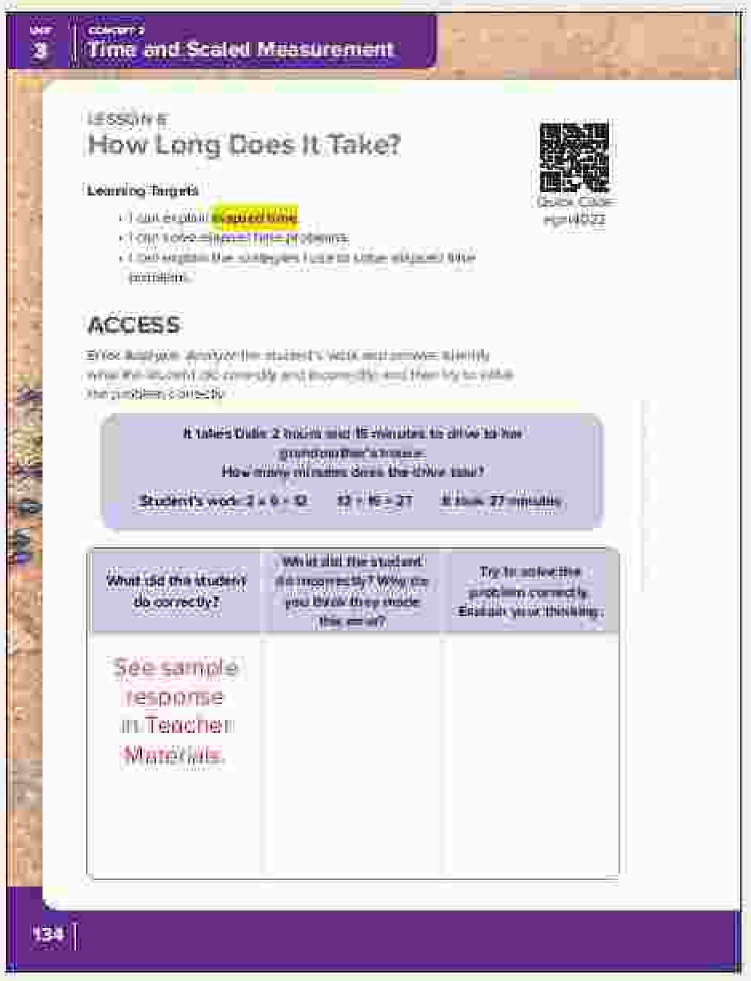
Lesson 6
How Long Does It Take?

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UNIT 3 | CONCEPT 2 | Time and Scaled Measurement

LESSON 6

How Long Does It Take?

Learning Targets

- I can explain elapsed time.
- I can solve elapsed time problems.
- I can explain the strategies I use to solve elapsed time problems.

ACCESS

Error Analysis: Analyze the student's work and answer. Identify what the student did correctly and incorrectly and then try to solve the problem correctly.

It takes Dale 2 hours and 15 minutes to drive to her grandmother's house. How many minutes does the drive take?

Student's work: 2 × 6 = 12   12 + 15 = 27   It took 27 minutes.

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.
See sample response in Teacher Materials.		

134

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to calculate elapsed time that requires them to regroup hours and minutes or minutes and seconds.
- Students may be unsure how to write equations with time.
- Students may not have effective strategies for converting time intervals and solving elapsed time problems.
- Students often confuse regrouping in elapsed time problems with regrouping in the Base Ten number system.

Error Analysis

1. Direct students to Lesson 6 ACCESS Error Analysis and ask them to complete the error analysis.
2. Review the answers as a class.
   The student recognized the need to convert the hours to minutes before adding. However, the student incorrectly multiplied by 6 instead of 60. They also correctly added on the extra minutes, but the final answer should have been 135 minutes.

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BUILD (40 min)

Passage of Time (15 min)

1. Ask students to chorally read today's Learning Targets.
2. Direct students to Lesson 6 BUILD Passage of Time and ask them to read the story problem silently.
3. Ask students to think about how the story problem is different from the kinds of problems they solved in the last math lesson. Call on students to share their thinking.
4. Reinforce that this problem is not about converting time like the last lesson, but about the passage of time or elapsed time. Explain that an equation can be written to represent the problem. Write on the board: 8:15 + 1:30 = *x*.
5. Explain that we write time in equations using the colon (:) even if we are representing the passage of time (and not telling time).
6. Ask students to work with a partner to solve the story problem.
7. Allow Wait Time for students to solve. Use Calling Sticks to call on 2–4 students to share their strategies for solving the problem. Record all strategies on the board.

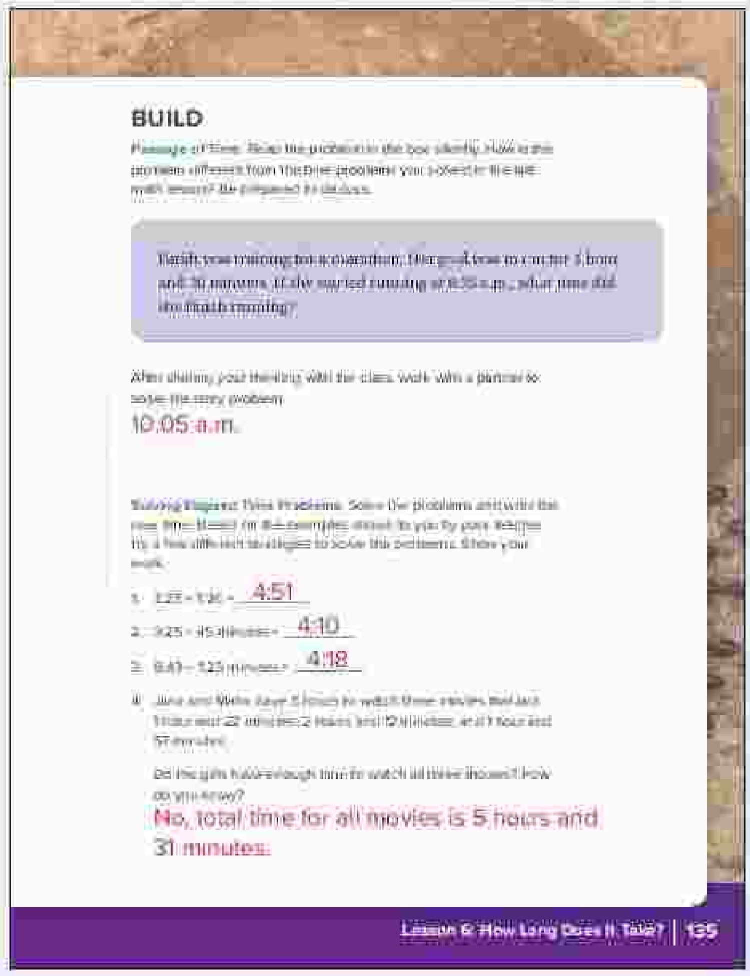
Solving Elapsed Time Problems (25 min)

TEACHER NOTE: This section introduces and models two problem-solving strategies for solving elapsed time problems (open number line and conversion). Depending on what strategies your students shared and tried in "Passage of Time," this direct instruction may be reinforcement for some. The goal is to ensure students have a range of problem-solving strategies so they can have options.

1. Draw an open number line on the board and record the following problem: Gamal has been hiking for 2 hours and 30 minutes. He has 55 minutes more to hike before he reaches the end. How long will his whole hike take?

PRINT

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BUILD

10:05 a.m.

1. 4:51
2. 4:10
3. 4:18
4. No, total time for all movies is 5 hours and 31 minutes.

Lesson 6: How Long Does It Take? | 135

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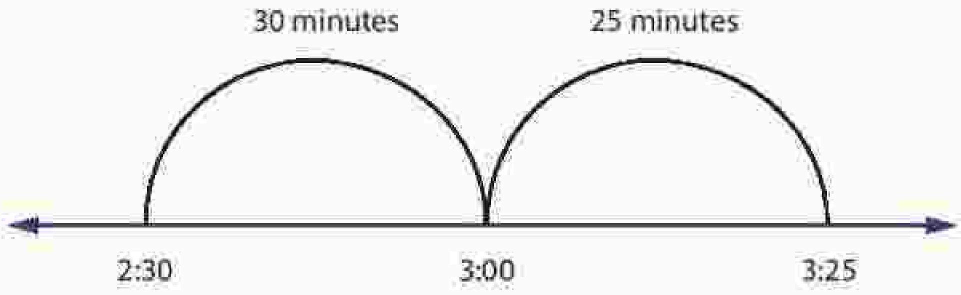
2. Ask students to Turn and Talk about how they might solve this problem. Students do not need to determine the answer yet, just discuss strategies to solve.

3. Use Calling Sticks to call on 2–3 students to share their thinking.

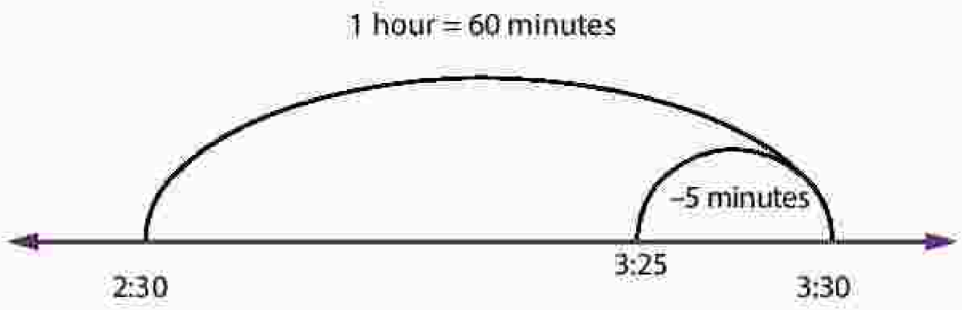
4. Model the following problem-solving strategies. Give students as much responsibility as possible for suggesting next steps, especially if they have already demonstrated some understanding of the process. Refer to the Steps for Solving Story Problems anchor chart as needed to promote student thinking.

   TEACHER NOTE: The following two strategies model open number lines for the hiking problem.

   - *Make an Hour*: Complete the hour (:30 + :30) and then add 25 minutes (:55 − :30) for a total of 3 hours and 25 minutes.



   - *Start with the Hours*: Add an hour (2:30 + 1:00 = 3:30) and then subtract 5 minutes (3:30 − :05 = 3:25) since 1 hour is 60 minutes.



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TEACHER NOTE: The following two strategies model conversion for the hiking problem.

- *Start with the Minutes:* Add the minutes 30 + 55 for a total of 85, and then subtract 60 minutes (1 hour):
  2 hours and 85 minutes – 60 minutes. 2 hours + 60 minutes = 3 hours.
  Answer: 3 hours and 25 minutes

2 hr 30 min
+ 55 min
2 hr 85 min = 3 hr 25 min
25   60

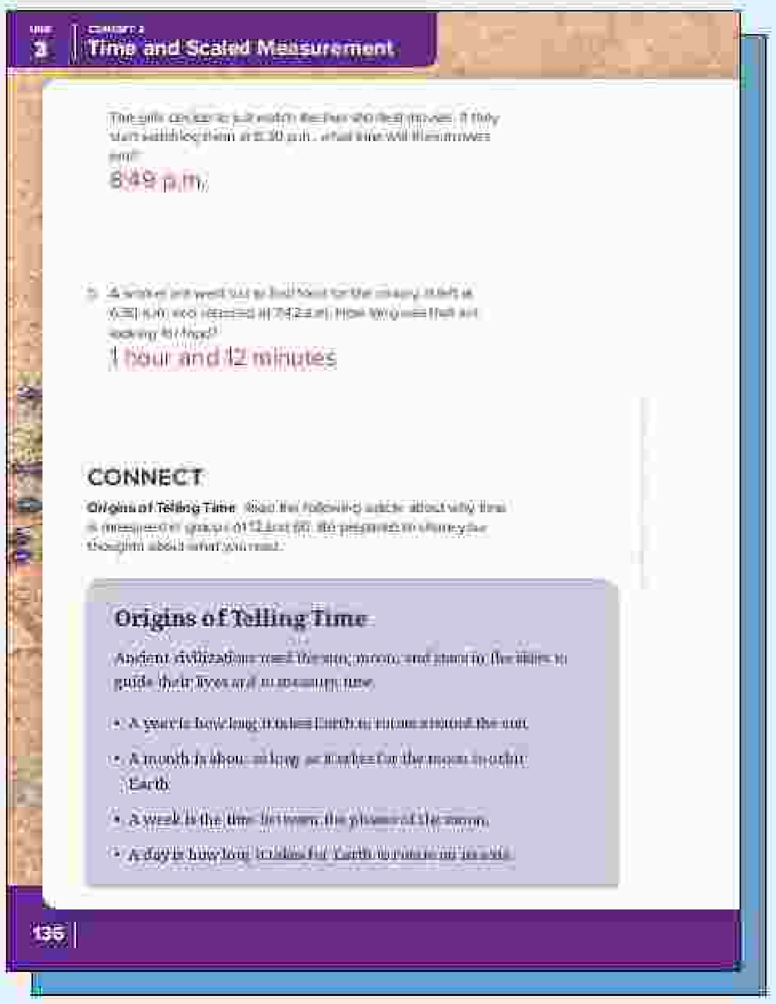
- *Convert to Minutes:* Convert 2 hours 30 minutes to 150 minutes, then add 55 minutes for a total of 205 minutes. Convert back to hours and minutes to get 3 hours and 25 minutes.
  2 hr 30 min = 60 min + 60 min + 30 min = 150 min
  150 min + 55 min = 205 min
  205 ÷ 60 = 3 plus remaining minutes OR 205 − 60 = 145 − 60 = 85 − 60 = 25 = 3 hr 25 min

5. Point to each strategy and ask students to stand if that problem-solving strategy makes the most sense to them.
6. Ask students to talk to their Shoulder Partner about how these strategies would work for a subtraction story problem.
7. Write the following problem on the board: Fatma has to bake chicken for 3 hours and 15 minutes in total. She has 38 minutes left on the timer. How long has the chicken been cooking?
8. Ask students to help you solve the problem using one of the strategies you modeled for them. If time allows, ask them to use a different strategy to solve the problem. Ask volunteers to demonstrate the strategy at the board.
9. Direct students to Lesson 6 BUILD Solving Elapsed Time Problems to complete Problems 1–5. Students can work independently, in small groups, or with the class, depending on their needs.
10. When there are about 5 minutes left in BUILD, review the answers as a class and clarify any challenging problems.

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Student Pages 136–137


UNIT 3 | Time and Scaled Measurement

8:49 p.m.

1 hour and 12 minutes

CONNECT

Origins of Telling Time

Origins of Telling Time

Ancient civilizations used the sun, moon, and stars in the skies to guide their lives and to measure time.

- A year is how long it takes Earth to rotate around the sun.
- A month is about as long as it takes for the moon to orbit Earth.
- A week is the time between the phases of the moon.
- A day is how long it takes for Earth to rotate on its axis.

136

CONNECT (7 min)

Origins of Telling Time

1. Direct students to Lesson 6 CONNECT Origins of Telling Time. Ask volunteers to read the reading passage aloud.
2. Ask students to share what they notice and wonder about the origins of telling time. Encourage students to continue to share and apply their learning about time outside of school.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to use a Fist-to-Five to self-assess their progress toward the Learning Targets.

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PRACTICE

Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions around elapsed time.

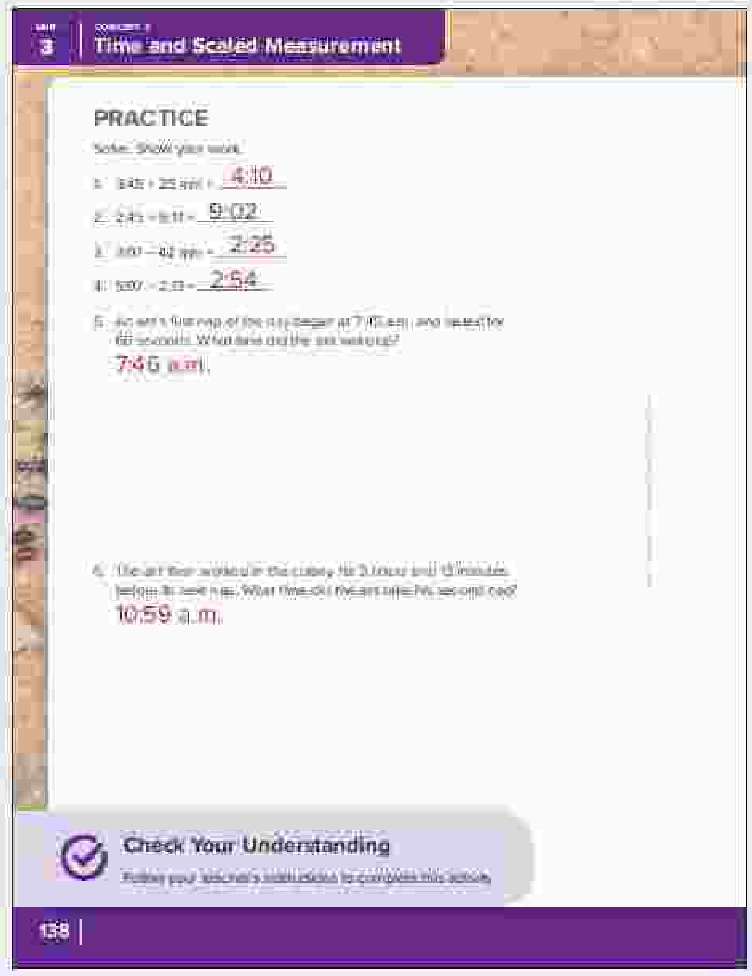
Check Your Understanding

Solve using two different strategies. Show your work. Accept any strategy that yields a correct answer.

1. Ant A worked from 7:05 a.m. until 8:52 a.m. How long did Ant A work?
   1 hour 47 minutes
2. Ant B started working at 11:25 a.m. and worked for 82 minutes. At what time did Ant B stop working?
   12:47 p.m.
3. How long did Ants A and B work all together?
   3 hours 9 minutes

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UNIT 3 | Time and Scaled Measurement

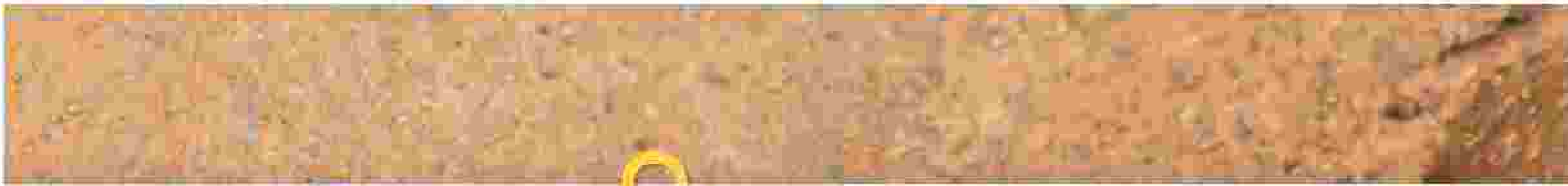
PRACTICE

1. 4:10
2. 9:02
3. 2:25
4. 2:54
5. 7:46 a.m.
6. 10:59 a.m.

Check Your Understanding

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LESSON 7
Scaled Measurements

Materials List

- Lesson 7 Image: Largest Fossilized Ant (Located at end of volume)

Preparation

No additional preparation needed

Lesson Overview

In this lesson, students review line plots to represent a set of measurement data. They create their own line plots with a measurement scale based on a given set of ant data. Then, they analyze the line plots to draw conclusions and answer questions about the data.

Lesson Essential Question

- How can I represent and interpret data using a scaled number line?

Learning Objectives

In this lesson

- Students will create line plots to represent given data.
- Students will select an appropriate key and scale for a line plot.
- Students will write questions that can be answered by their line plots.

Grade-Level Standards

4.D.1.c Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Vocabulary Check-In

line plot, scale

DIGITAL



Lesson 7

Scaled Measurements

Quick Code:
egmt4023

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

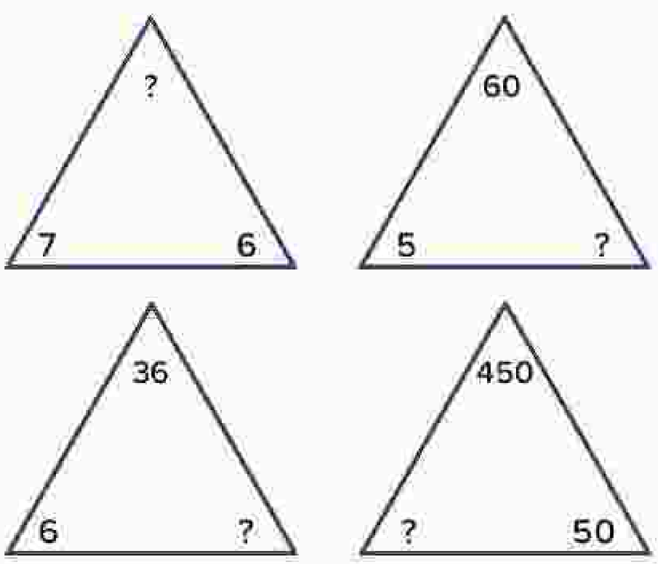
- Students may not understand how to represent data on a line plot.
- Students may not be sure what each X represents on a line plot.
- Students may incorrectly label the scale of a line plot or choose a key or scale that is not appropriate for the data.

Fun with Facts

1. Explain to students that they will review the relationship between multiplication and division with fact triangles. Multiplication is an operation we use when converting units of measurement.

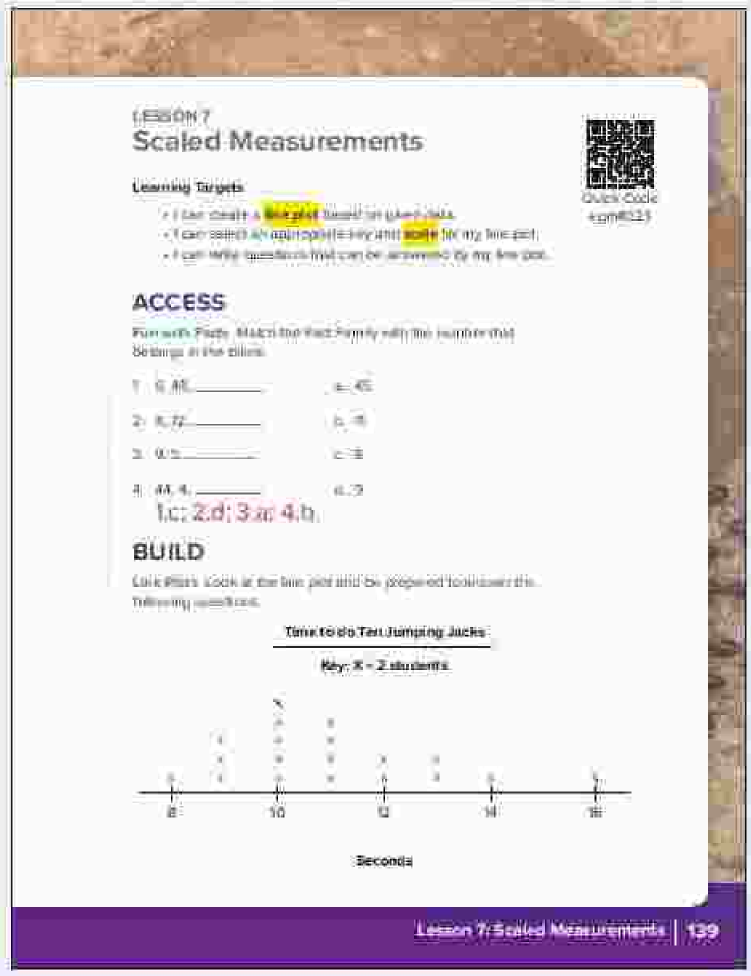
   TEACHER NOTE: These cards are purposely not drawn in the Student Edition so that students can mentally determine the missing number. If available, students can use white boards to show their answers, providing the teacher an opportunity to see what all students know and can do.

2. Draw fact triangles on the board. Examples are shown.



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LESSON 7
Scaled Measurements

Learning Targets

Quick Code

ACCESS

1. ______ a. 45
2. ______ b.
3. ______ c.
4. ______ d.

1.c; 2.d; 3.a; 4.b.

BUILD

Time to do Ten Jumping Jacks

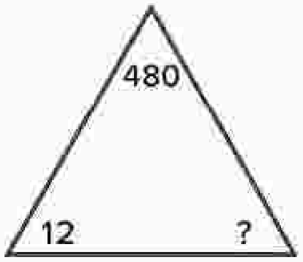
Key: X = 2 students

8 10 12 14 16

Seconds

Lesson 7: Scaled Measurements | 139

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3. Ask students to think quietly and give a Thumbs-Up when they know the answer to one or more of the problems. Give Wait Time so that all students have enough time to think about the problems. Call on several students who have their Thumbs-Up and record their answers on the board.
4. Ask students to explain their thinking. Record their ideas on the board so other students can see the problem-solving strategies their classmates are using.
5. Ask students to Turn and Talk about the following question:
   - *How can knowing your multiplication facts help you know your division facts?*
6. Reinforce the concept that multiplication and division facts are related, are inverse (opposite) operations, and that multiplication and division "fact families" are identical.
7. Ask students to turn to Lesson 7 ACCESS Fun With Facts and complete Problems 1–4.

BUILD (40 min)

Line Plots (10 min)

1. Ask a student to read the Learning Targets aloud.
2. Pose the following question and ask students to Turn and Talk:
   - *If you collected data on how long it took each person in the class to do 10 jumping jacks, or if you collected measurement data about a collection of rocks, how could you display that information for others to see and understand?*
3. Use Calling Sticks to choose 2–3 students to share their ideas.
   Possible answers may include: chart, graph, line plot, or table
4. Ask students to discuss the difference between a line plot (discussed in depth in Primary 3) and a bar graph or a table. If necessary, share any of the following points students did not mention:
   - Bar graphs provide a visual display in a bar format to compare quantities in different categories or groups.
   - Tables present information quickly in rows and columns.
   - A line plot is a graph that displays data using a number line. It uses X's above each data value to show the number of occurrences.

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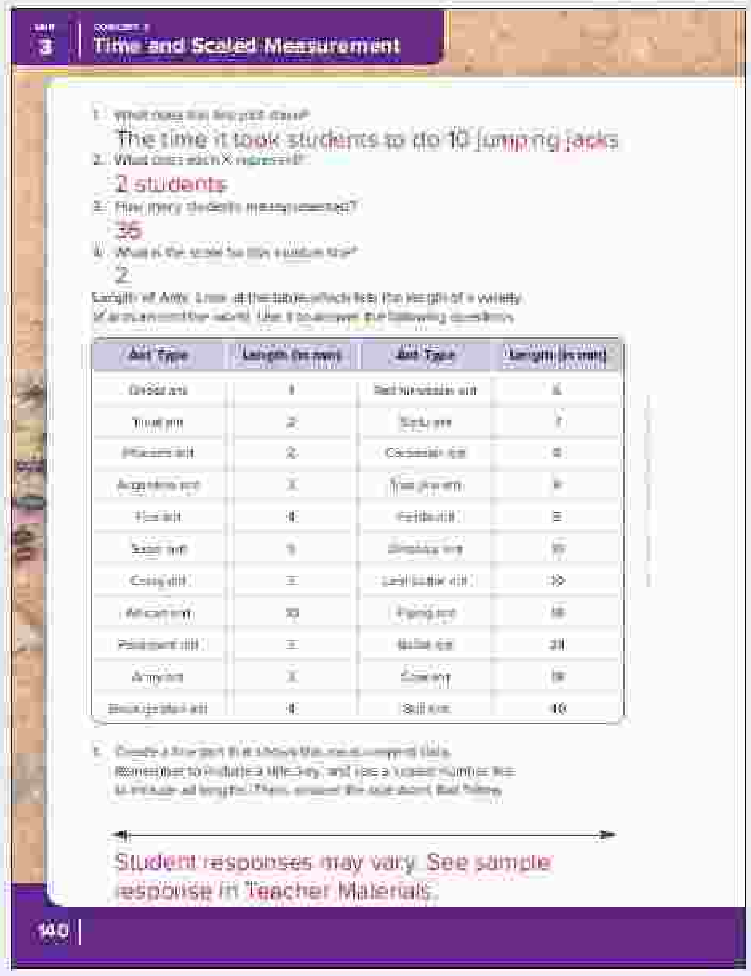
5. Direct students to Lesson 7 BUILD Line Plot Review to look at the line plot as you ask the following questions:
   - *What does this line plot show?* (The time it takes students to do 10 jumping jacks)
   - *What does each X represent?* (2 students)
   - *How many students are represented? How do you know?* (36. Count all Xs by 2)
   - *What is the scale for this number line?* (2)
6. Review the definition of scale and share the following:
   - Scales on number lines and line plots show marks at equal intervals.
   - Scales are labeled with numbers and represent real quantities.
   - Scales are often used to help represent data and measurements.
   - The scale represents a relationship between the units being used. For example, in the line plot in the Student Edition, the scale represents the relationship between seconds and the actual measurement data that were collected. The line plot starts at 8 seconds and goes to 16 seconds, counting by 2. The scale is 2.

Length of Ants (30 min)

1. Ask students to hold up with their fingers to show their estimate of the average length of ants. Ask several students to estimate how many millimeters (or centimeters) they are showing.
2. Display the image of the largest fossilized ant (found at the end of the volume), read the text aloud, and ask students to talk with a partner about what they notice and wonder.
3. Direct students to Lesson 7 BUILD Length of Ants.
4. Explain to students that the table has measurement data about the length of a variety of ants. Ask the following questions and have students share their thinking with their Shoulder Partner:
   - *What will go along the line?*
   - *What do the numbers represent?*
   - *How will you represent the number of ants? Will each X represent one ant or more?*

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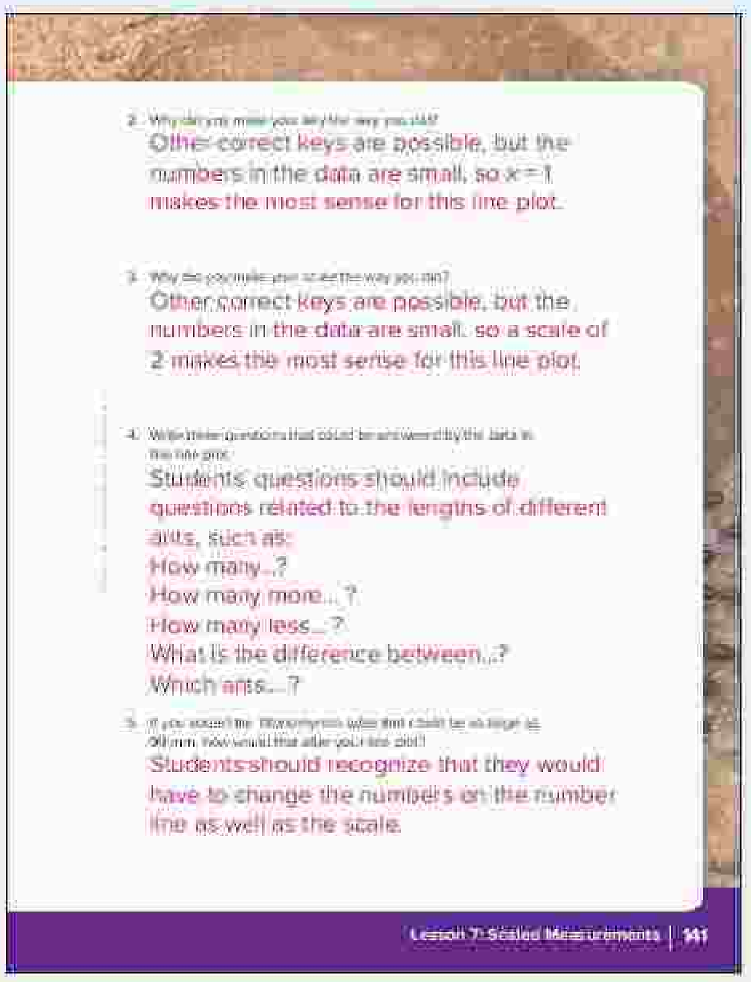
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Student Page 141


Other correct keys are possible, but the numbers in the data are small, so x = 1 makes the most sense for this line plot.

Other correct keys are possible, but the numbers in the data are small, so a scale of 2 makes the most sense for this line plot.

Students' questions should include questions related to the lengths of different ants, such as:
How many...?
How many more...?
How many less...?
What is the difference between...?
Which ants...?

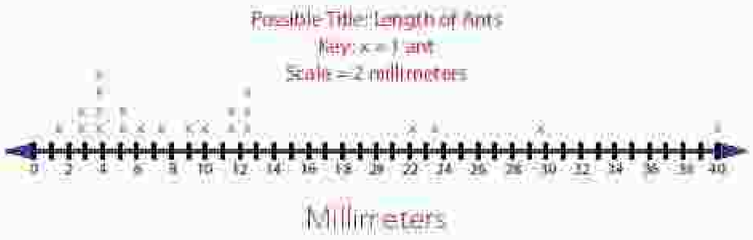
Students should recognize that they would have to change the numbers on the number line as well as the scale.

Lesson 7: Scaled Measurements | 141

- *What scale will you use? In other words, how will you divide up your line to make sure that the length of the Bull Ant (40 millimeters) can be represented in the space you are given?*

5. Direct students to display this measurement data on a line plot and then answer the remaining questions. Students could work independently or with a partner.
6. When 5–7 minutes are left in BUILD, direct students to open their Student Edition to display their line plot. Go on a Gallery Walk so that students can see and respond to each other's work.

Answer Key for Length of Ants:

1. 

2. Other correct keys are possible, but the numbers in the data are small, so x = 1 makes the most sense for this line plot.
3. Other correct keys are possible, but the numbers in the data are small, so a scale of 2 makes the most sense for this line plot.
4. Students' questions should include questions related to the lengths of different ants, such as:
   - How many...?
   - How many more...?
   - How many less...?
   - What is the difference between...?
   - Which ants...?
5. Students should recognize that they would have to change the numbers on the number as well as the scale.

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CONNECT (7 min)

Scales Everywhere We Look

1. Explain to students that we actually see scales everywhere we look. Ask students to think quietly, then raise their hands to share some examples of scales they see in their daily lives and at school. Examples may include rulers, meter sticks, clocks, weight scales, scales that measure mass, and maps.

2. Direct students to Lesson 7 CONNECT Scales Everywhere We Look to see another example of the use of scales—graduated cylinders (which students may have mentioned).

Answer Key for Scales Everywhere We Look:

1. What title would you use to represent this data?
   Students should create a title related to liquid in the graduated cylinders, such as Liquid in Graduated Cylinders or Graduated Cylinder Volumes.

2. What key would you use to represent this data?
   Since there is a small set of data, students should choose a key of 1.

3. What scale would you use to represent this data?
   Students may choose to use a scale of 5 or 10, though 5 is the most appropriate scale.

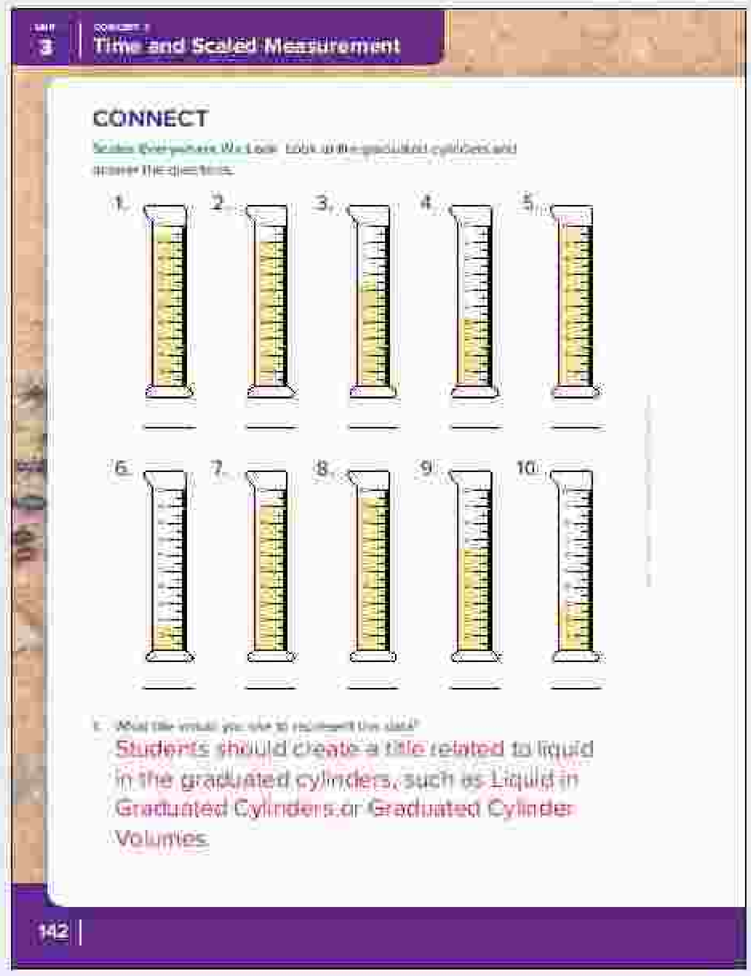
WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to discuss how they choose a key and a scale when creating a line plot. Ask questions to promote discussion, since many students still may not understand how to effectively do this. Reinforce effective strategies.

PRINT

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3 | Time and Scaled Measurement

CONNECT

1. 2. 3. 4. 5.

6. 7. 8. 9. 10.

Students should create a title related to liquid in the graduated cylinders, such as Liquid in Graduated Cylinders or Graduated Cylinder Volumes.

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2. What key would you use to represent this data?

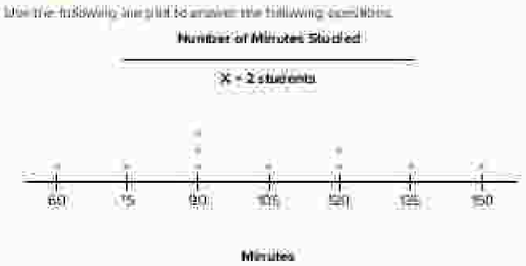
Since there is a small set of data, students should choose a key of 1.

3. What scale would you use to represent this data?

Students may choose to use a scale of 5 or 10, though 5 is the most appropriate scale.

PRACTICE

Use the following line plot to answer the following questions.



1. What is being measured?

Time spent studying in minutes.

PRACTICE

Direct students to Lesson 7 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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Check Your Understanding

1. A line plot has a scale of 5. The first number on the scale is 15. There are 6 marks on the line plot. What is the last number on the line? 40



2. The key of a line plot indicates that each x = 4 children. One of the data points on the line has 6 X's. How many children does that represent? 24 children

3.

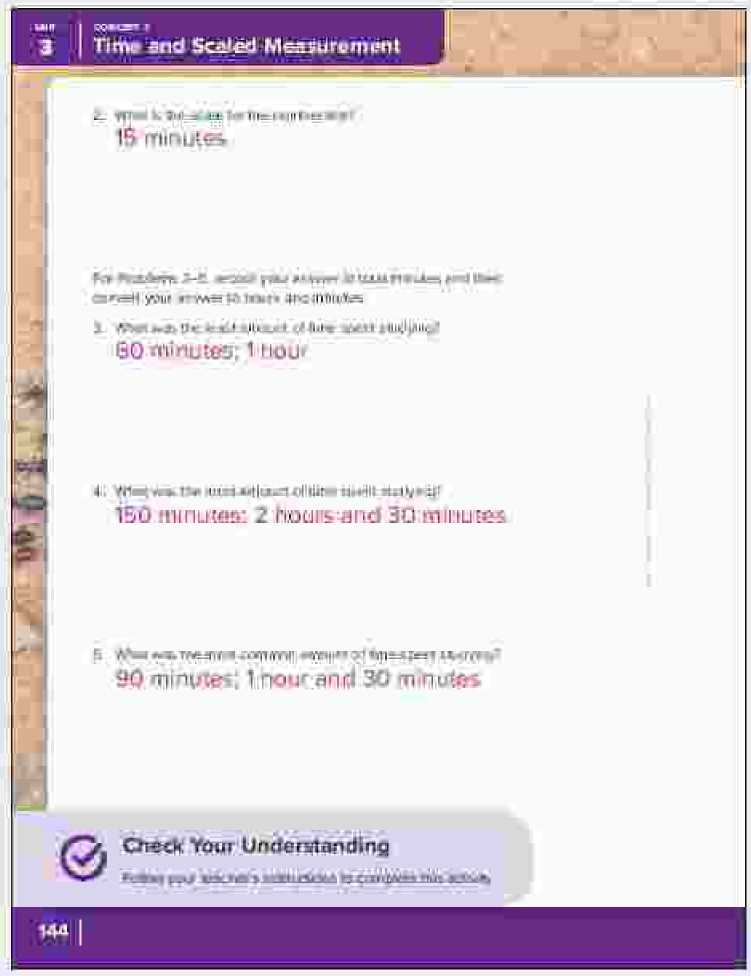


4. Write a question that could be answered by looking at your line plot. Answers will vary, but should be based on the data on the line plot.

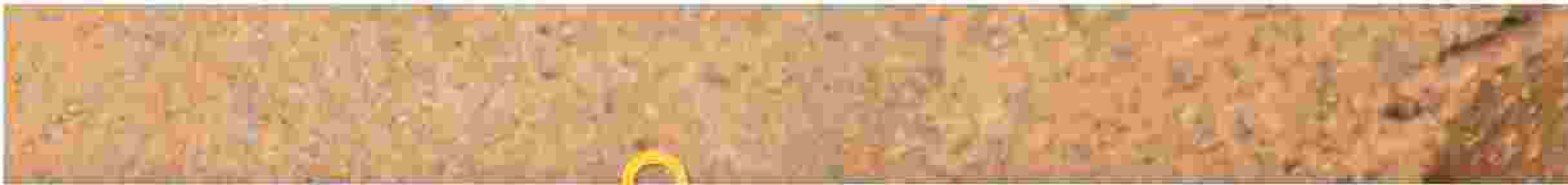
5. Write another question that could be answered by looking at your line plot. Answers will vary, but should be based on the data on the line plot.

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Materials List

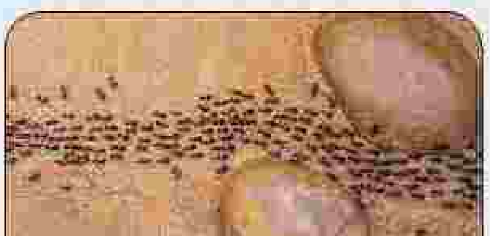
- Materials may vary

Preparation

No additional preparation needed

Photo Credit: Elisaveta Galitckaia / Shutterstock.com

DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4024

Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Time and Scaled Measurements. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What are the relationships between units of time?
- What strategies are most effective and efficient for me when solving problems?
- How can I represent and interpret data with a scaled number line?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to time and scaled number lines.

Grade-Level Standards

4.D.1.a Demonstrate understanding of relative sizes of measurement units within one system of units including length (millimeters, centimeters, decimeters, meters, kilometers), mass (grams, kilograms, tons), capacity (milliliter and liter), and time (second, minute, hour, day).

4.D.1.b. Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

4.D.1.c Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Vocabulary Check-In

Review concept vocabulary as needed.

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COMMON MISCONCEPTIONS AND ERRORS

- Students may struggle to read time on an analog clock. They may confuse the hour and the minute hands or think that the digits on the clock are in 5-minute intervals.
- Students may struggle to remember the conversions for time: how many seconds in a minute, minutes in an hour, hours in a day, days in a week.
- Students may not have effective strategies to convert time intervals and solve elapsed time problems.
- Students may not understand how to represent data on a line plot.
- Students may incorrectly label the scale of a line plot or choose a key or scale that is not appropriate for the data.

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Remediation: Correcting Misconceptions

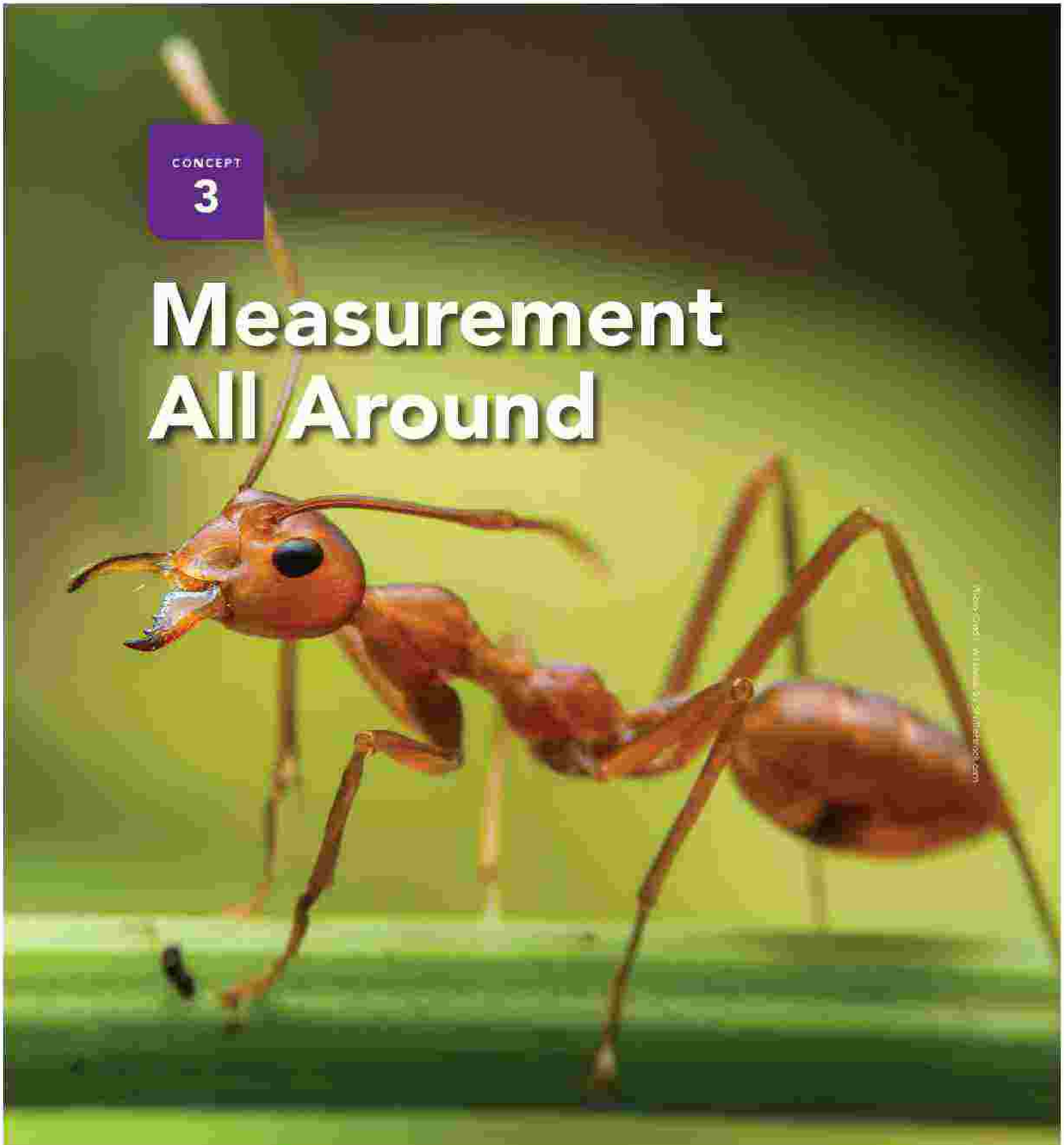
If...	Then...
Students struggle to tell time on an analog clock accurately.	Revisit the telling time lessons in Primary 3. Review Ratio Tables in Lesson 5. Review the parts of the clock and practice reading and writing time. Consider creating clock faces using paper plates, brads, and paper clock hands. Have students practice telling time to the hour, half-hour, quarter-hour, 5 minutes, and minute. Also, reinforce stretching out the clock into a number line that shows the 5-minute intervals. Create and administer a clock fluency worksheet where students have 1 minute to read and record the time for 10–15 clocks. These can be done periodically to practice and build fluency.
If...	**Then...**
Students struggle to convert time units.	Review Ratio Tables in Lesson 5. Work with small groups of students to create ratio tables and use them to practice simple conversions. Model for students how to record each step in the conversion process.

If...	Then...
Students struggle to accurately represent data on a scaled number line.	Review Line Plots from Lesson 7. Practice reading a variety of line plots and then use a small sample size of data and work with small groups of students to create a line plot to represent the data.
If...	**Then...**
Students struggle to select an appropriate scale for their line plots.	Review the definition of scale and share multiple examples. Then ask students to consider the relationship between the scale and the data being represented. Ask students how they would best count the data if they were going to skip count. That strategy may help students recognize appropriate scales for their line plots.



CONCEPT 3

Measurement All Around



Concept Overview

In Concept 3: Measurement All Around, students apply their understanding of measurement and converting measurement units and apply the four operations to solve a variety of story problems. Multiplication and division are explored in Theme 2 of Primary 4, so the numbers used for these operations in this unit are appropriate for students to work with at this time.

Concept Standards

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Concept Planner

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
8 Measuring the World around Me Part 1	• Steps to Solving Story Problems anchor chart (Displayed) • Display other strategy anchor charts you have created	Review vocabulary as needed.	• Students will add and subtract to solve problems. • Students will solve story problems involving measurement. • Students will apply a variety of strategies to solve story problems.	
9 Measuring the World around Me Part 2	• Video: Leaf Cutter Ants and Fungus • Anchor charts used in Lesson 8	Review vocabulary as needed.	• Students will multiply and divide to solve problems. • Students will solve story problems involving measurement. • Students will apply a variety of strategies to solve story problems.	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to solving measurement story problems using the four operations.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions. • Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.	So Many Strategies, Writing About Math, Practice, Check Your Understanding
	• Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions. • Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.	Ant Math, Multistep Measurement, Exit Ticket, Practice, Check Your Understanding
	• Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions. • Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.	

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LESSON 8
Measuring the World around Me Part 1

Lesson Overview

In this lesson, students use addition and subtraction to solve multistep story problems involving length, mass, capacity, and time. Students demonstrate flexibility using a variety of strategies and reflect on which strategies are most effective and efficient for them.

Lesson Essential Question

- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will add and subtract to solve problems.
- Students will solve story problems involving measurement.
- Students will apply a variety of strategies to solve story problems.

Grade-Level Standard

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Steps to Solving Story Problems anchor chart (displayed)
- Display other strategy anchor charts you have created

Preparation

No preparation needed

DIGITAL



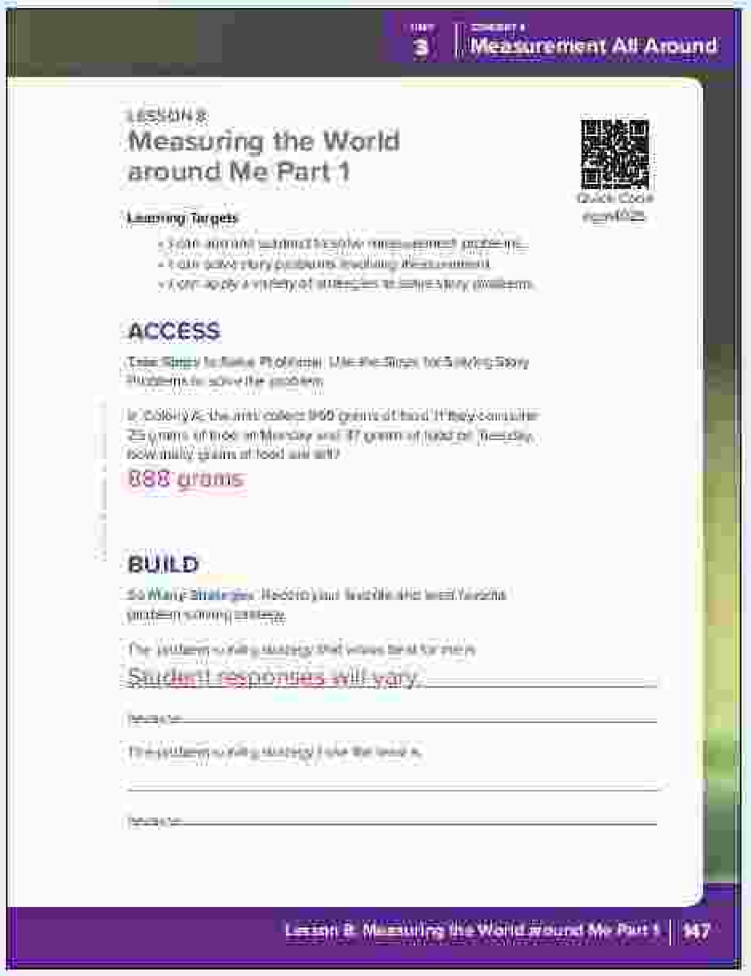
Lesson 8
Measuring the World around Me Part 1

Quick Code: egmt4025

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions.
- Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.

Take Steps to Solve Problems

1. Direct students' attention to the Steps for Solving Story Problems anchor chart. Ask volunteers to read and discuss how each step helps them solve story problems.
2. Direct students to Lesson 8 ACCESS Take Steps to Solve Story Problems. Ask students to work independently to solve the problem using the Steps for Solving Story Problems. When finished, have students share their work with a partner to compare solutions.
3. Remind students that the steps are simply a process to approach problem-solving, and there are many strategies they can use to solve problems.

BUILD (40 min)

So Many Strategies

1. Write the following problem-solving strategies on the board for the class to see:
   - Estimate
   - Use smaller numbers
   - Draw a picture or model (number line, bar model, diagram, and so on)
   - Write an equation with the unknown
   - Use the standard algorithm

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- Find a hidden question
- Convert measurement units first
- Make a benchmark number

2. Ask students to add any other strategies they can think of. They may refer to other strategy anchor charts on display. Accept all reasonable answers.
3. Ask students to identify any strategies they would like to see modeled again. Take few minutes to review and model 2–3 strategies, as needed.
4. Direct students to Lesson 8 BUILD So Many Strategies. Ask students to fill in the blanks to share their favorite and least favorite problem-solving strategies.
5. Ask students to discuss the strategies they like to use most often. Encourage students to share their reasoning, using math terminology whenever possible.
6. Ask students to work with partners or in small groups to solve the story problems in their Student Edition. Encourage students to discuss and try different problem-solving strategies.

   TEACHER NOTE: Students may not have enough time to finish all the problems. They can do the problems in any order. The purpose is to encourage students to learn new problem-solving strategies from their classmates and to try new strategies. Allow students to discuss their approaches with each other and model strategies for each other when possible.

7. With about 10 minutes left in BUILD, regroup students and go over the answers together. Ask volunteers to model a few of the problem solutions at the board. Ask students to raise their hands if they tried a new problem-solving strategy today. Discuss.

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3 | Measurement All Around

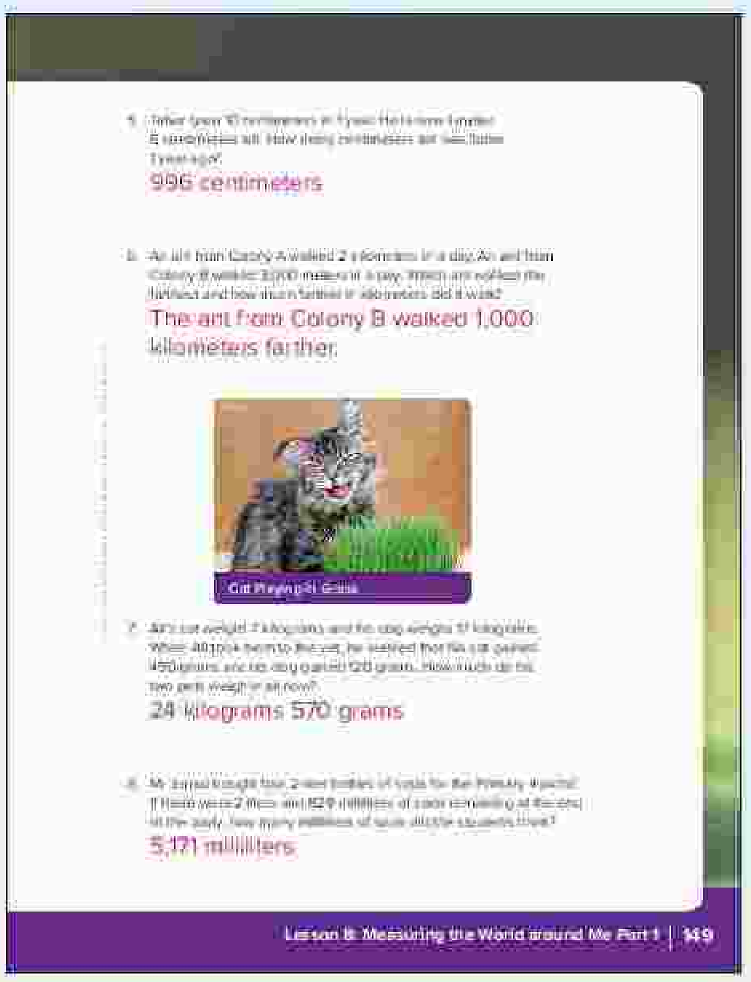
1. 4,755 grams
2. Carpenter ant, 39 days longer
3. 80 liters
4. 19 kilograms

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PRINT

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996 centimeters

The ant from Colony B walked 1,000 kilometers farther.

24 kilograms 570 grams

5,171 milliliters

Lesson 8: Measuring the World around Me Part 1 | 149

CONNECT (7 min)

Writing About Math

Direct students to Lesson 8 CONNECT Writing About Math and read the prompt aloud. Ask students to respond to the prompt.

TEACHER NOTE: Consider using this entry as a formative assessment to determine whether or not students are able to explain how they solve problems and why they chose the problem-solving strategy they did.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss their experience solving problems today. What was challenging? What did they learn? What was surprising to them? How did they feel about trying different strategies? Why?

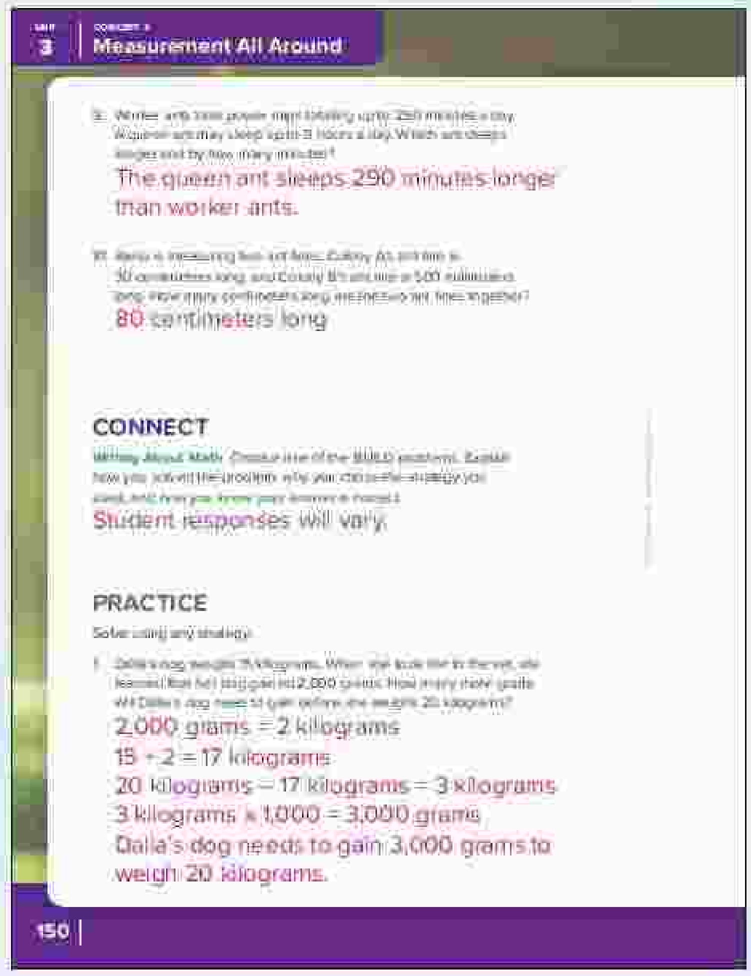
F4_Math_T1_U3_C3_TE.indd Page 265 11/08/21 4:15 PM f-0311 /150/DIB00002/work/indd/Package_from_Client_SE TE/TE_matter/F4_Math_T1_U

PRACTICE

Direct students to Lesson 8 PRACTICE and have them complete the problems. Address student errors and misconceptions.

PRINT

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UNIT 3 | CONCEPT 3
Measurement All Around

9. [illegible]

The queen ant sleeps 290 minutes longer than worker ants.

10. [illegible]

80 centimeters long

CONNECT

[illegible]

Student responses will vary.

PRACTICE

[illegible]

1. [illegible]

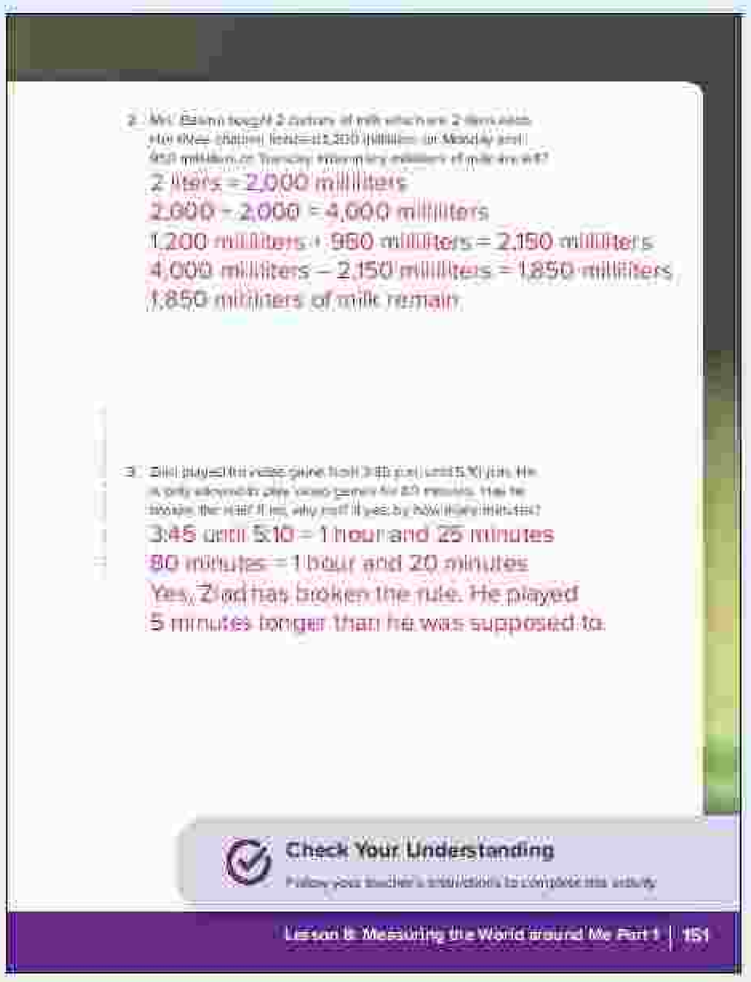
2,000 grams = 2 kilograms
15 + 2 = 17 kilograms
20 kilograms − 17 kilograms = 3 kilograms
3 kilograms × 1,000 = 3,000 grams
Dalia's dog needs to gain 3,000 grams to weigh 20 kilograms.

150

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2 liters = 2,000 milliliters
2,000 + 2,000 = 4,000 milliliters
1,200 milliliters + 960 milliliters = 2,150 milliliters
4,000 milliliters − 2,150 milliliters = 1,850 milliliters
1,850 milliliters of milk remain

3:45 until 5:10 = 1 hour and 25 minutes
80 minutes = 1 hour and 20 minutes
Yes, Ziad has broken the rule. He played
5 minutes longer than he was supposed to.

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 8: Measuring the World around Me Part 1 | 151

Check Your Understanding

Students should use a different strategy to solve each problem than the strategy they used in PRACTICE. Accept all strategies that yield a correct answer.

1. Dalia's dog weighs 15 kilograms. When she took her to the vet, she learned that her dog gained 2000 grams. How many more grams will Dalia's dog need to gain before she weighs 20 kilograms?
   Dalia's dog needs to gain 3,000 grams to weigh 20 kilograms.
2. Mrs. Basma bought 2 cartons of milk which are 2 liters each. Her three children finished 1200 milliliters on Monday and 950 milliliters on Tuesday. How many milliliters of milk are left?
   1,850 milliliters of milk remain.
3. Ziad played his video game from 3:45 p.m. until 5:10 p.m. He is only allowed to play video games for 80 minutes. Has he broken the rule? If no, why not? If yes, by how many minutes?
   Yes, Ziad has broken the rule. He played 5 minutes longer than he was supposed to.

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LESSON 9
Measuring the World around Me Part 2

Lesson Overview

In this lesson, students use multiplication and division to solve multistep story problems involving length, mass, and capacity. The multiplication and division problems focus on facts 1–12 and multiples of 10. Students apply a variety of strategies and identify the most effective and efficient ones for them.

Lesson Essential Question

- Which problem-solving strategies are most effective and efficient for me?

Learning Objectives

In this lesson

- Students will multiply and divide to solve problems.
- Students will solve story problems involving measurement.
- Students will apply a variety of strategies to solve story problems.

Grade-Level Standards

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Video: Leaf Cutter Ants and Fungus
- Anchor charts used in Lesson 8

Preparation

No additional preparation needed.

DIGITAL



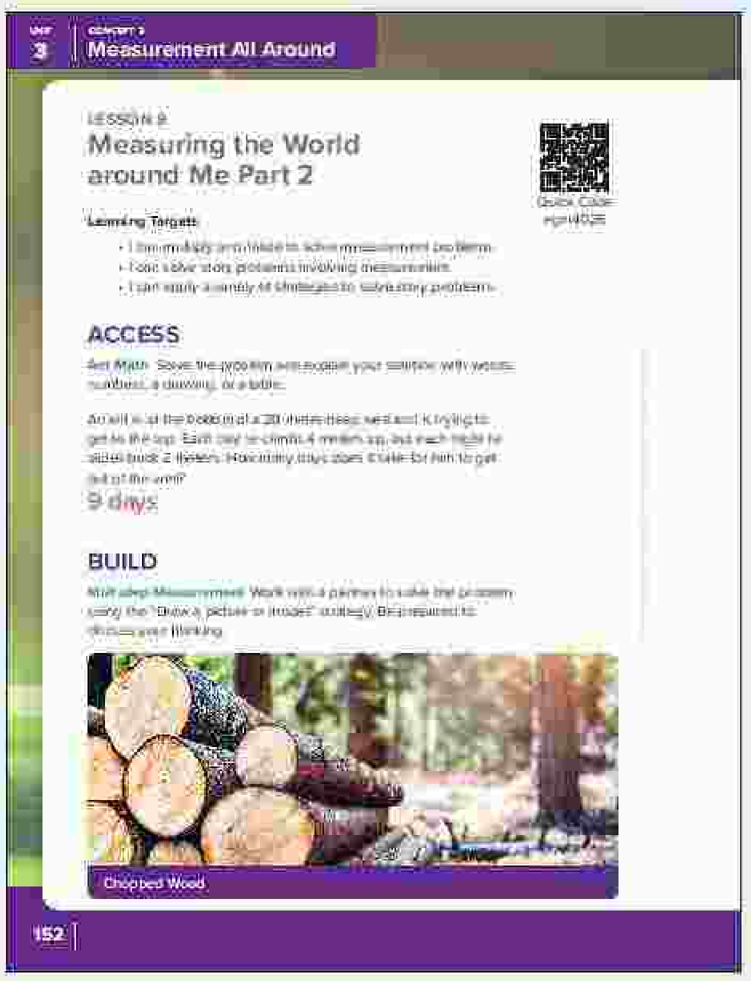
Lesson 9

Measuring the World around Me Part 2

Quick Code: egmt4026

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UNIT 3 | CONCEPT 3
Measurement All Around

LESSON 9
Measuring the World around Me Part 2

Learning Targets
[illegible]

ACCESS
[illegible]

9 days

BUILD
[illegible]

Chopped Wood

152

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions.
- Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.

Ant Math

1. Direct students to Lesson 9 ACCESS Ant Math. Read the directions aloud. Ask a volunteer to read the story problem aloud. Give students a few minutes to solve the problem.

2. Use Calling Sticks to choose 2–3 students to share their approach to solving the question.

   TEACHER NOTE: Some students will jump right in with an algorithm, while others will attempt a drawing or model. The most effective solutions combine the two approaches, along with an explanation of their reasoning.

3. Reinforce the importance of clearly understanding the assumptions behind problems by drawing a picture or model. In this problem, the ant does not have to fall back on the fifth day.

   Answer Key for Ant Math:
   It takes the ant 9 days to climb 20 meters and get out of the well. (Students do not have to create a table to solve this problem. A table is used here to illustrate the solution.)

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Day	Distance Climbed	Distance Fallen	Total Distance Traveled
1	4 meters	2 meters	2 meters
2	4 meters	2 meters	4 meters
3	4 meters	2 meters	6 meters
4	4 meters	2 meters	8 meters
5	4 meters	2 meters	10 meters
6	4 meters	2 meters	12 meters
7	4 meters	2 meters	14 meters
8	4 meters	2 meters	16 meters
9	4 meters	0 meters	20 meters – he is out!

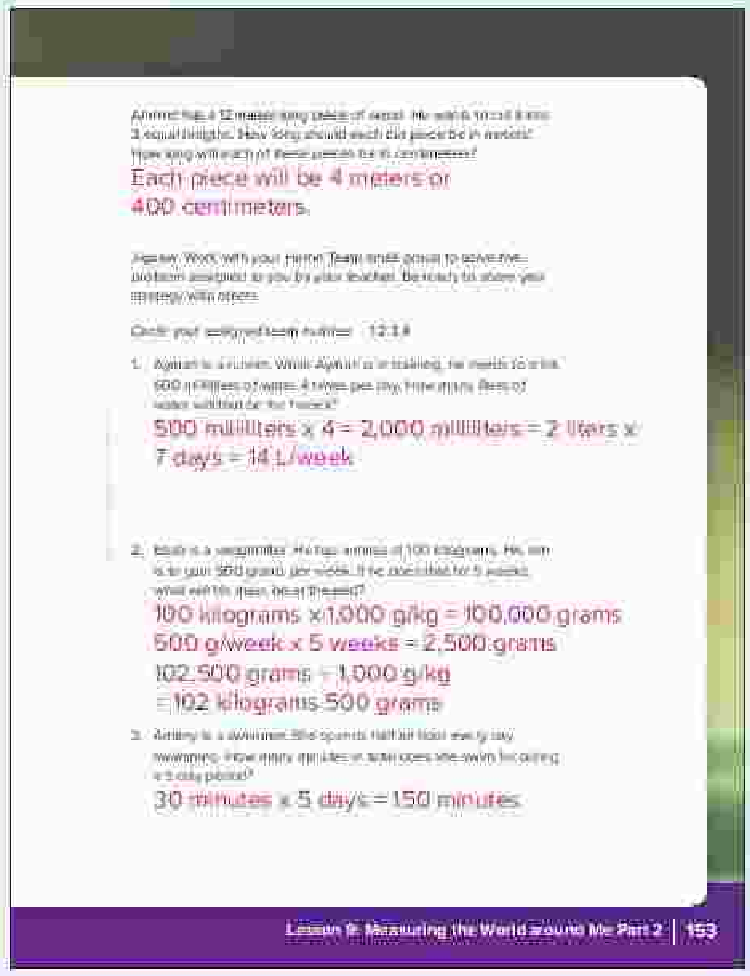
BUILD (40 min)

Multistep Measurement (10 min)

1. Ask students to turn to Lesson 9 BUILD Multistep Measurement and read the directions and story problem silently.
2. Ask the following questions to prompt thinking about the story problem.
   - *What can you draw to help you solve the problem?*
   - *Can you solve this problem in one step, or will it take more than one step? How do you know?*
   - *What operations do you think you might use to solve the problem? Why do you think so?*
3. Choose one pair of students to come to the board and work out the problem together. Ask seated students to work with a partner to solve the problem on their own.
4. When ready, direct the pair of students at the board to share their solution and problem-solving strategy with the class.
5. Encourage the seated students to ask questions and provide feedback to the students at the board. Ask students to discuss any different strategies they used to solve the problem.

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Each piece will be 4 meters or 400 centimeters.

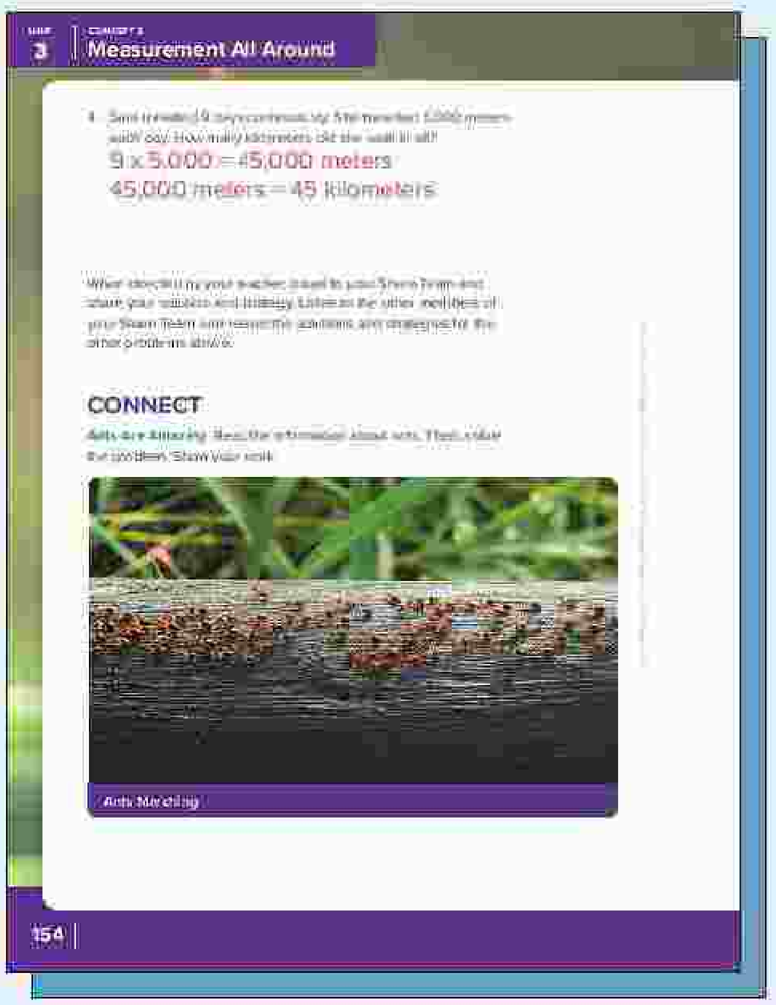
1. 500 milliliters x 4 = 2,000 milliliters = 2 liters x 7 days = 14 L/week
2. 100 kilograms x 1,000 g/kg = 100,000 grams
   500 g/week x 5 weeks = 2,500 grams
   102,500 grams ÷ 1,000 g/kg
   = 102 kilograms 500 grams
3. 30 minutes x 5 days = 150 minutes

Lesson 9: Measuring the World around Me Part 2 | 153

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6. Ensure all students have recorded the correct answer.

7. Ask the following question and allow several students to respond:

   - *How do you know what strategy to use to solve problems? How do you choose which strategy you will use?*

Jigsaw (30 min)

1. Create small groups by counting students off by four (in other words, the first student is 1, the second student is 2, the third student is 3, the fourth student is 4, the fifth student is 1, the sixth student is 2, and so on until all students have an assigned number). Put all the 1's together, 2's together, 3's together and 4's together. These are students' "Home Teams."

2. Ask students to turn to Lesson 9 BUILD Jigsaw. Assign each group the corresponding problem in Lesson 9 BUILD Jigsaw. Students should work together to solve their assigned problem.

   TEACHER NOTE: Students should only solve the one problem assigned to their group. As students work, facilitate and encourage good math discussion. Students may discuss estimation and/or other strategies used in previous lessons to help guide their decision making. This should take 8 to 10 minutes.

3. After student groups have solved their problems, help students reorganize into new groups (called "Share Teams") so that each new team has a 1 student, a 2 student, a 3 student, and a 4 student.

4. Give each student in the group a few minutes to teach the other students in their "Share Team" how they solved their assigned problem. Encourage the group to ask clarifying questions so they understand the problem-solving strategies and solution being shared.

5. When a few minutes are left in BUILD, review all answers and clarify any lingering misconceptions.

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CONNECT (7 min)

Ants Are Amazing

1. Direct students to Lesson 9 CONNECT Ants are Amazing. Ask volunteers to read the passage aloud. Ask students to briefly share what they notice and wonder.
2. Show students the video Leaf Cutter Ants and Fungus.
3. Ask students to solve Problem 1.

   TEACHER NOTE: Collect students' books and review their work. This task can be used as a formative assessment to determine which students may need additional instruction and practice. Accept all strategies that yield a correct answer.

WRAP-UP (3 min)

Let's Chat About Our Learning

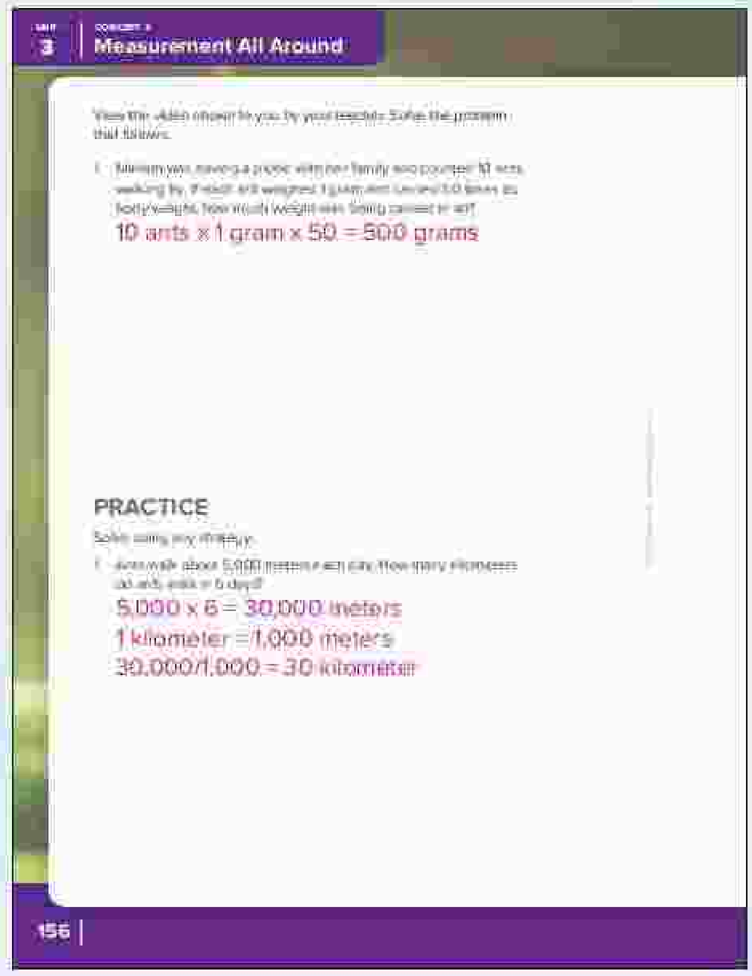
Ask students to self-assess their progress in this Unit using a Fist-to-Five. Ask volunteers to share their reasons for their self-assessment.

PRACTICE

Direct students to Lesson 9 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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3 | Measurement All Around

10 ants × 1 gram × 50 = 500 grams

PRACTICE

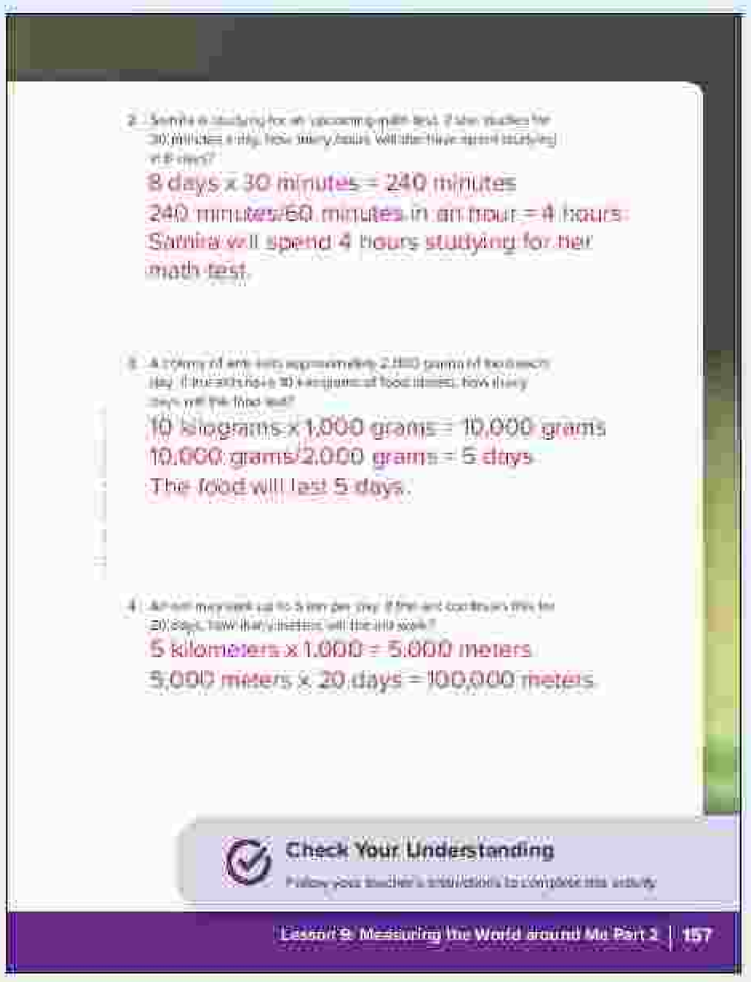
5,000 × 6 = 30,000 meters
1 kilometer = 1,000 meters
30,000/1,000 = 30 kilometer

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Student Page 157


8 days x 30 minutes = 240 minutes

240 minutes/60 minutes in an hour = 4 hours

Samira will spend 4 hours studying for her math test.

10 kilograms x 1,000 grams = 10,000 grams

10,000 grams/2,000 grams = 5 days

The food will last 5 days.

5 kilometers x 1,000 = 5,000 meters

5,000 meters x 20 days = 100,000 meters

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 9: Measuring the World around Me Part 2 | 157

Check Your Understanding

Accept all strategies that yield a correct answer.

1. Ants walk about 5,000 meters each day. How many kilometers do ants walk in 6 days?
   30,000/1,000 = 30 kilometers
2. Samira is studying for an upcoming math test. If she studies for 30 minutes a day, how many hours will she have spent studying in 8 days?
   Samira will spend 4 hours studying for her math test.
3. A colony of ants eats approximately 2,000 grams of food each day. If the ants have 10 kilograms of food stored, how many days will the food last?
   The food will last 5 days.
4. An ant may walk up to 5 kilometers per day. If the ant continues this for 20 days, how many meters will the ant walk?
   100,000 meters

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 3 Measurement All Around. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Question

- Which problem-solving strategies are most effective and efficient for me?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to solving measurement story problems using the four operations.

Grade-Level Standard

4.D.1.b Use the four operations to solve word problems involving distances, intervals of time, liquid capacity, masses of objects, and money.

Vocabulary Check-In

Review concept vocabulary as needed.

Materials List

- Materials may vary

Preparation

No additional preparation needed

DIGITAL



Concept Check-In and Remediation

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COMMON MISCONCEPTIONS AND ERRORS

- Students may not have effective and efficient strategies for problem solving. They may rely on a time-consuming strategy or one that yields inaccurate solutions.
- Students may not have flexible strategies for problem solving. They may rely on one strategy alone, even if that strategy is ineffective or inappropriate for the given problem.

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Remediation: Correcting Misconceptions

If...	**Then...**
Students do not have effective or efficient strategies for problem solving.	Review So Many Strategies from Lesson 8 and Multistep Measurement from Lesson 9. Drawing the problems provides an important visual to facilitate student thinking about the mathematical relationships among the numbers of a given story problem. Be sure that students explain that a strategy is how to use the numbers and how you use relationships and connections between numbers to solve a problem.
If...	**Then...**
Students are having difficulty with the conversions for length, capacity, or mass.	Review Metric Units from Lesson 1. Review Decomposing and Renaming from Lesson 3. Review Mass Review from Lesson 2.

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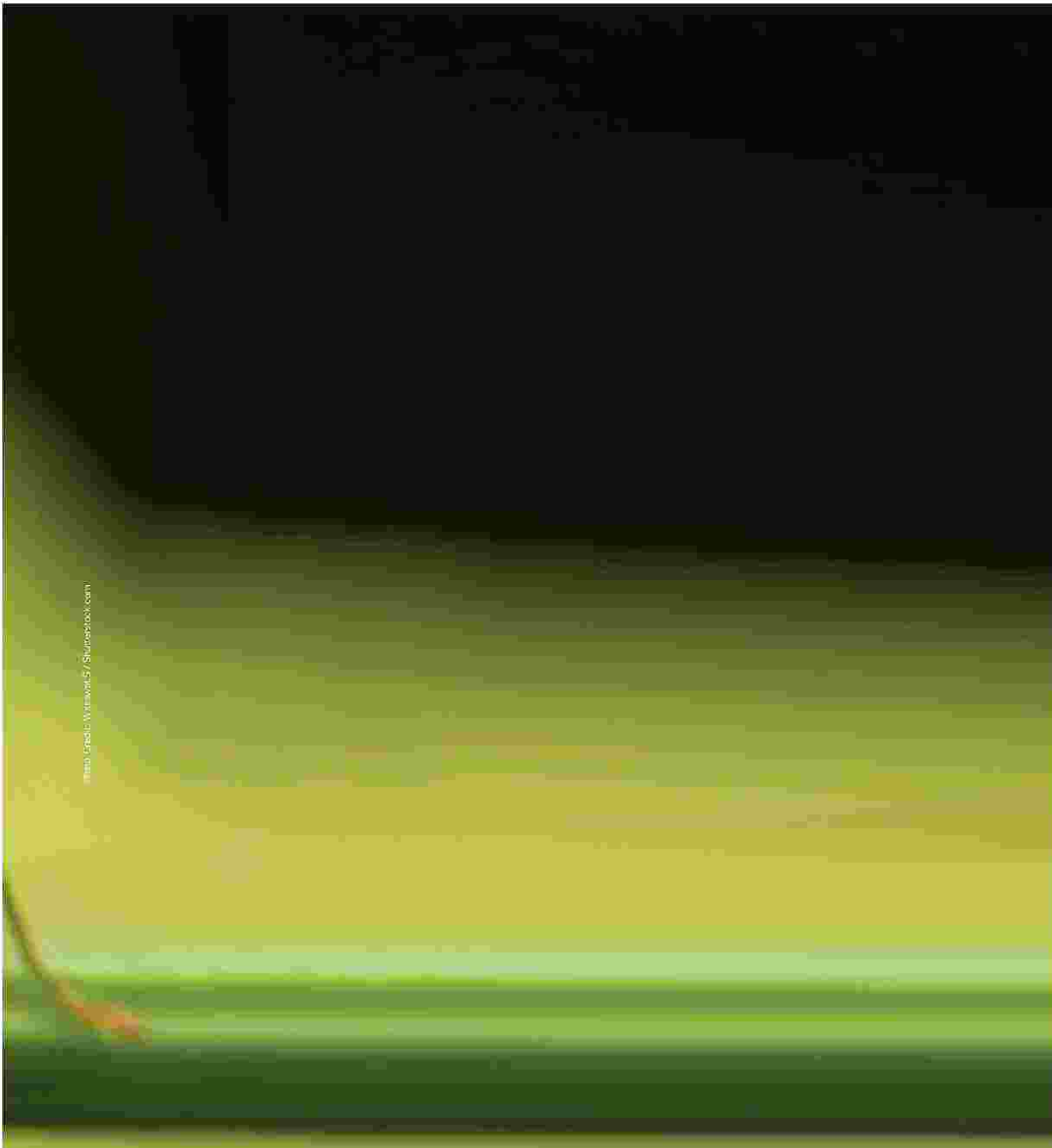
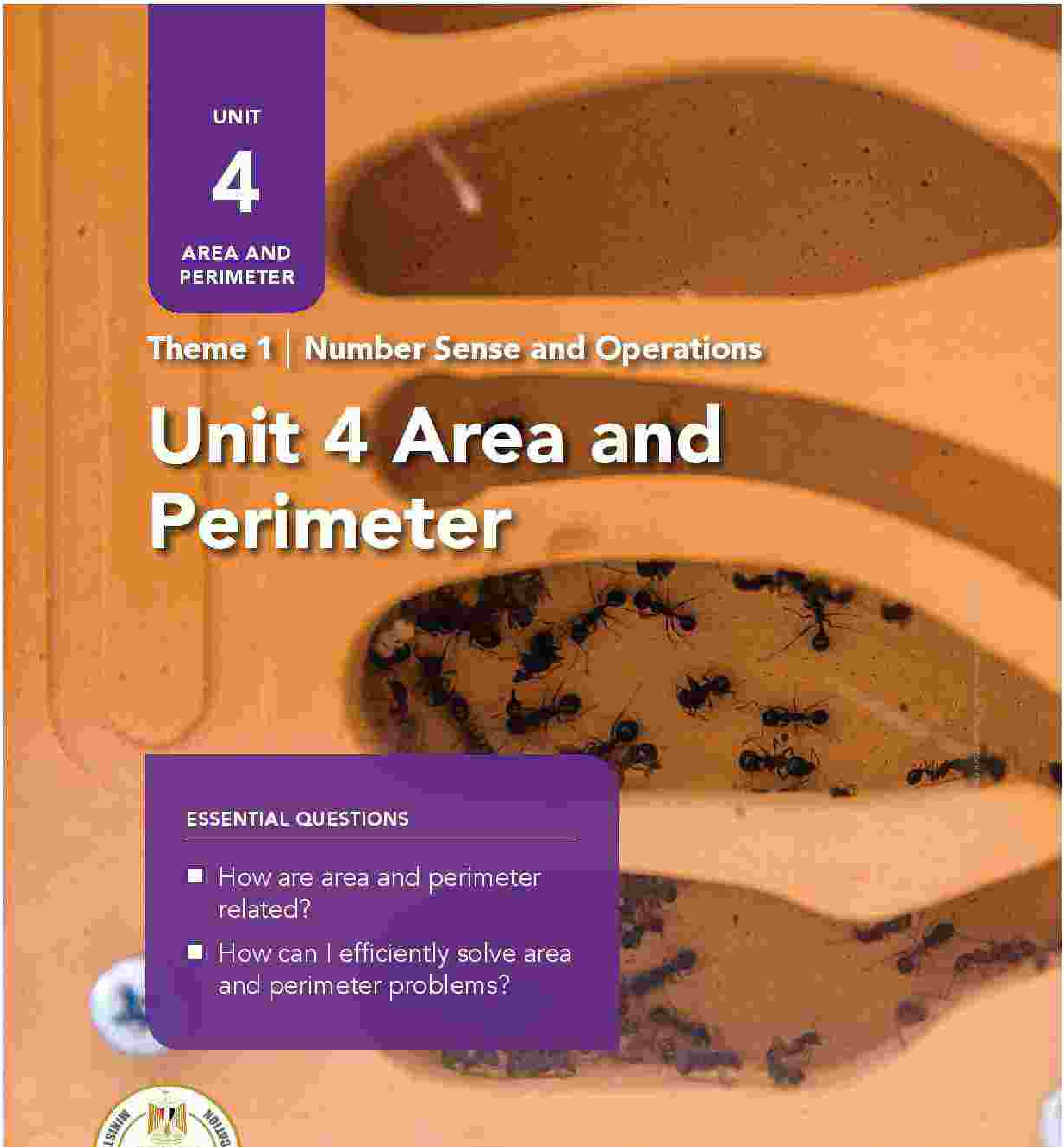


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UNIT

4

AREA AND PERIMETER

Theme 1 | Number Sense and Operations

Unit 4 Area and Perimeter

ESSENTIAL QUESTIONS

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

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Video Questions

The Unit 4 Opener Video, Hungry Ants, shows how area and perimeter are used to measure an ant's journey to find food. Omar and Mariam are observing a group of worker ants in the park. When ants leave the colony, they can travel long distances. To study the ants, Omar and Mariam decide to only observe the ants while they are in a certain space. They may need some help creating boundaries for this space.

- What shape should Omar and Mariam make their observation space?
- Why do worker ants travel long distances away from their colony?
- Can the ants be contained in the space Omar and Mariam create?

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egmt4083

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

area, array, comparison, complex, dimensions, formula, length, multiplicative, perimeter, quadrilateral, scale, square units, sum, two-dimensional, unknown, width

Quick Code
egmt4084

Unit Storyline

Unit 4 Area and Perimeter Storyline

The Area and Perimeter unit extents students' working knowledge calculating the perimeter and area of polygons. Students apply these understandings to the application of formulas for area and perimeter to solve an unknown dimension in rectangles and squares and to solve real-world problems. To support learning, students observe video footage and investigate problems of ants within the environment to enhance students' knowledge of area and perimeter.

Unit Standards

4.D.1	Solve problems involving measurement and conversion of measurements.
4.D.1.d	Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

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Unit 4 Structure and Pacing

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.

Concept 1: Explore Area and Perimeter

Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

<table>
<tr>
<td>Lesson 1</td>
<td>Marching Ants
Learning Objectives
• Students will define perimeter.
• Students will use formulas to calculate the perimeter of rectangles.
• Students will explain how to calculate perimeter.
Student Learning Targets
• I can define perimeter.
• I can use formulas to calculate the perimeter of rectangles.
• I can explain how to calculate perimeter.</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>Fill the Space
Learning Objectives
• Students will define area.
• Students will use formulas to calculate the area of rectangles.
• Students will explain how to calculate area.
Student Learning Targets
• I can define area.
• I can use formulas to calculate the area of rectangles.
• I can explain how to calculate area.</td>
</tr>
</table>

Unit Structure and Pacing *cont'd*

Lesson 3	**Something Is Missing!** **Learning Objective** • Students will use formulas to calculate unknowns when given some dimensions of rectangles. **Student Learning Target** • I can use formulas to calculate unknowns when given some dimensions of rectangles.
Lesson 4	**Odd Shapes** **Learning Objectives** • Students will calculate the area and perimeter of complex shapes. • Students will explain their strategies for finding the area and perimeter of complex shapes. **Student Learning Targets** • I can find the area and perimeter of complex shapes. • I can explain my strategy for finding area and perimeter of complex shapes.
Lesson 5	**Growing Dimensions** **Learning Objective** • Students will use area and perimeter formulas to solve multiplicative comparison problems. **Student Learning Target** • I can use area and perimeter formulas to solve multiplicative comparison problems.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to area and perimeter. **Student Learning Target** • I can correct my misconceptions and errors related to area and perimeter.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

Reduce ACCESS by 3 minutes

Reduce BUILD by 8 minutes

Reduce CONNECT by 2 minutes

Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section:

- Discuss fewer examples
- Eliminate Shoulder Partner conversations
- Shorten class discussions
- Work with students to complete ACCESS problems

If Mathematics instruction is based on 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

Follow the 45-minute approach for the 45-minute days

Teach two 45-minute lessons on the 90-minute day

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

Increase ACCESS by 5 minutes

Increase BUILD by 20 minutes

Increase CONNECT by 3 minutes

Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section:

- Discuss additional examples as needed
- Extend class discussions
- Allow time for hands-on work with manipulatives and models
- Provide additional practice problems for students who need additional practice
- Encourage students to share and model their problem-solving strategies

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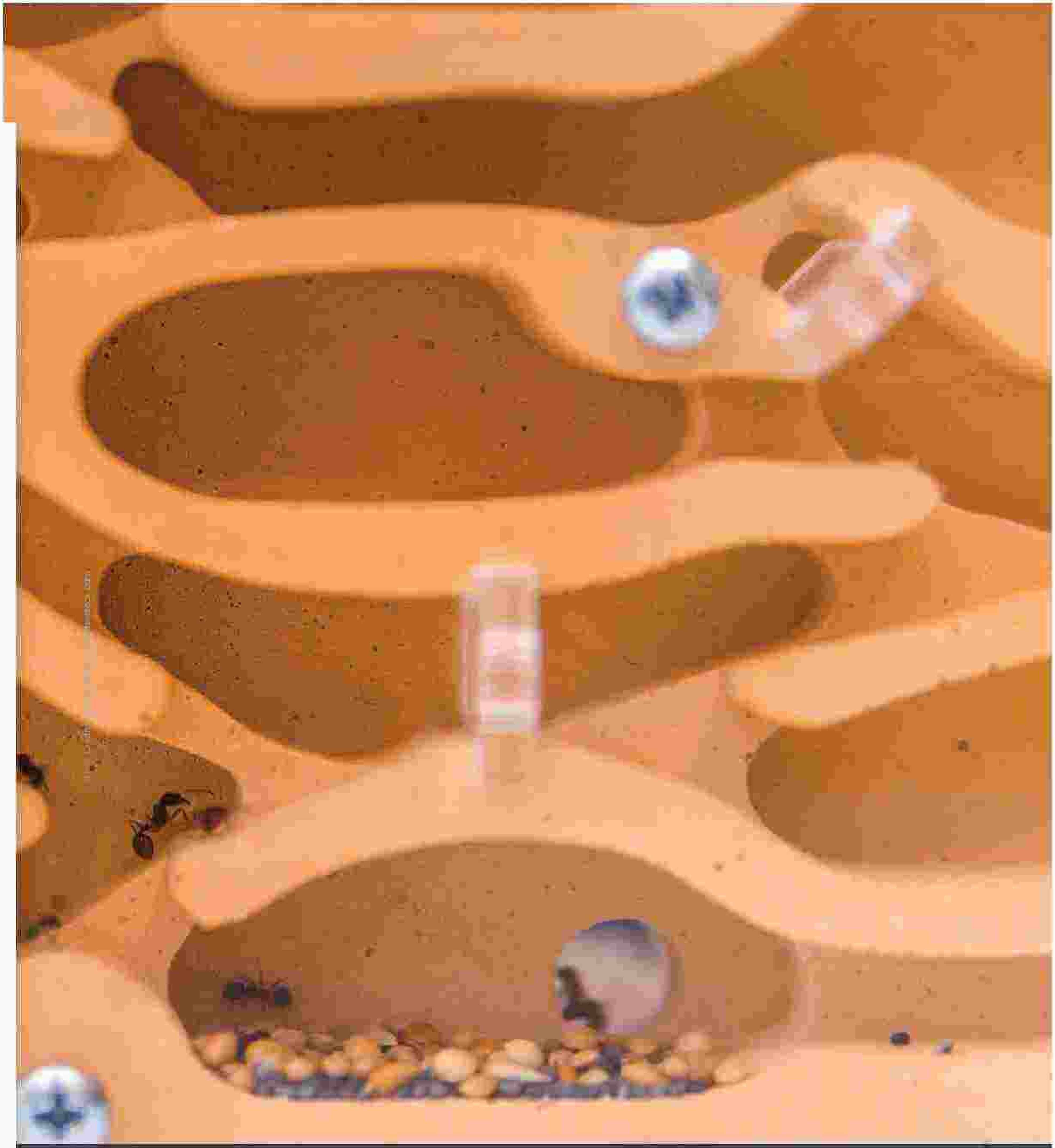
Mathematical Background Knowledge

Area and Perimeter

In Primary 3, students calculated the area and perimeter of quadrilaterals. They solved for area and perimeter in both bare number problems and story problems. They calculated the perimeter of other polygons including trapeziums and compound shapes. Although students were exposed to formulas for finding area and perimeter, the formulas were not formally taught. In Primary 4, students review perimeter and extend this knowledge by creating formulas to determine the area of rectangles and squares. They review area and create a formula ($l \times w$) that they use moving forward to determine the area of any rectangle or square.

Students in Primary 4 apply formulas for area and perimeter to solve for an unknown dimension in rectangles and squares and to solve real-world problems. Students review strategies, identify the formulas for both area and perimeter, and calculate unknowns when given some dimensions of the rectangle. They also solve multiplicative comparison problems involving area and perimeter.

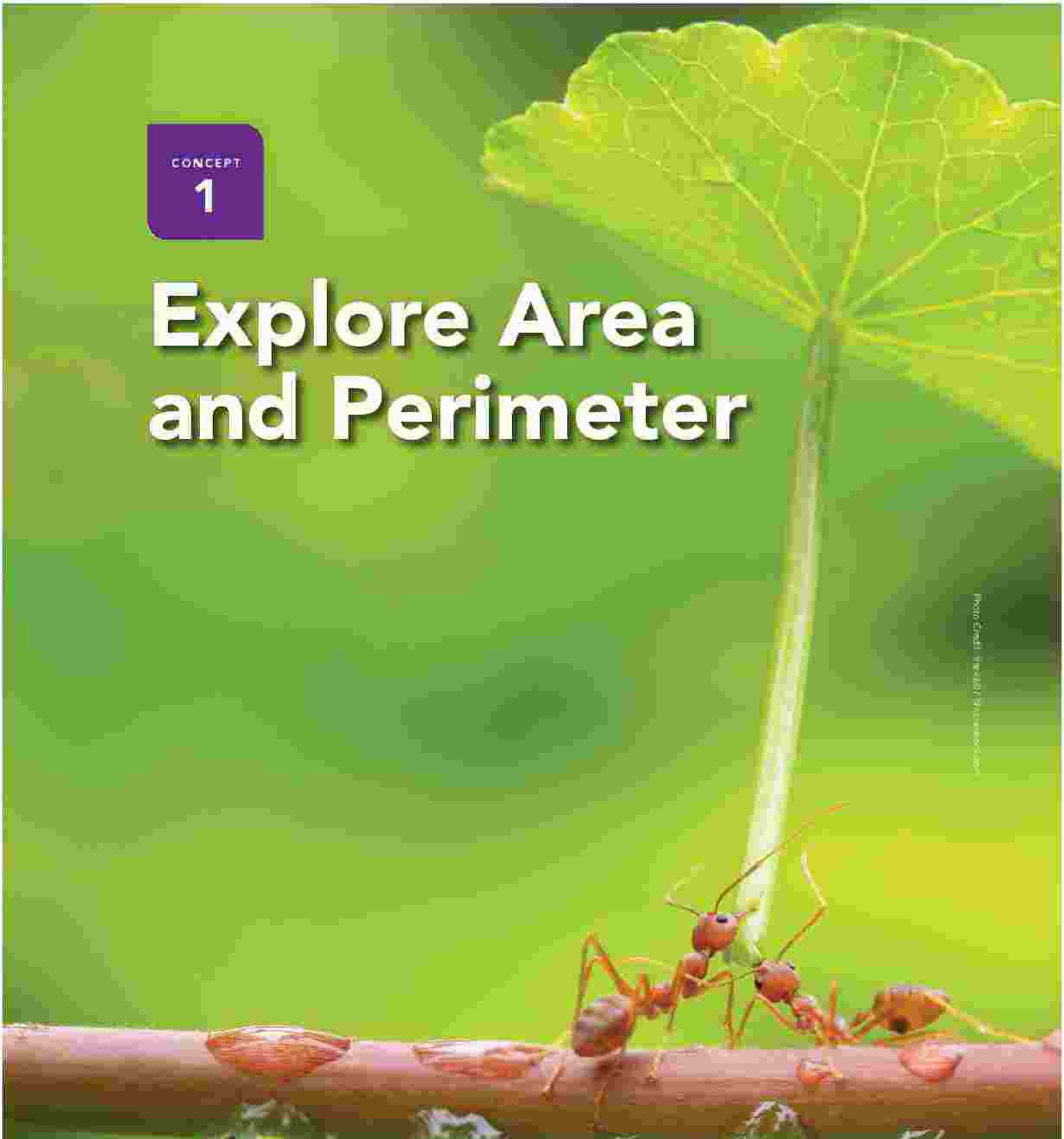
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CONCEPT

1

Explore Area and Perimeter



Concept Overview

In Concept 1: Explore Area and Perimeter, students investigate the two-dimensional measurement properties of length, width, perimeter, and area. Students learn and understand the importance of area and perimeter in real-life situations. Students calculate the area of rectangles, use formulas to calculate unknowns when given some dimensions of rectangles, and know how to find the perimeter of any shape. In Theme 2, students delve into multiplication and division. This final unit of Theme 1 is a launch into that study with a conceptual and real-life application.

Concept Standards

4.D.1 Solve problems involving measurement and conversion of measurements.

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Marching Ants	• Large version of the Perimeter Formulas for Rectangles anchor chart **Perimeter Formulas for Rectangles** $P = 2l + 2w$ $P = l + l + w + w$ $P = 2 \times (l + w)$ $P = 4s$ (Square only; where s = side) • Thinking Like a Mathematician anchor chart	Formula Length Perimeter Quadrilateral Scale Sum Width	• Students will define perimeter. • Students will use formulas to calculate the perimeter of rectangles. • Students will explain how to calculate perimeter.	
2 Fill the Space	• Large version of the Area Formula for Rectangles anchor chart **Area Formula for Rectangles** $A = l \times w$	Area Length Two-dimensional Width	• Students will define area. • Students will use formulas to calculate the area of rectangles. • Students will explain how to calculate area.	

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may confuse unit names for area and perimeter by using unit squares instead of units. • Students may think that perimeter is the sum of the length and the width because area is the product of length and width.	Foraging for Formulas, Carpenter March, Practice, Check Your Understanding
	• Students may confuse unit names for area and perimeter by using units instead of square units. • Students may confuse area and perimeter in both what the question is asking and by using an incorrect formula.	Number Talk, Area Practice, Carpet Tile, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
3 Something Is Missing!	• Unit 4 Lesson 3 SCOOT cards (1 card per pair of students) (Photocopy the Blackline Master at the end of the volume.) • Unit 4 Lesson 3 SCOOT answer key (At the end of the volume)	Area Dimensions Formula Perimeter Unknown	• Students will use formulas to calculate unknowns when given some dimensions of rectangles.	
4 Odd Shapes	• Unit 4 Lesson 4 Shape Cards (1 card per student) (Photocopy and cut apart cards.) • Scissors • Tape	Area Complex Perimeter	• Students will calculate the area and perimeter of complex shapes. • Students will explain their strategies for finding the area and perimeter of complex shapes.	
5 Growing Dimensions	• Cut six 10 cm × 10 cm squares out of colored construction paper (1 set for the teacher) • Tape	Array Multiplicative comparison Square units	• Students use area and perimeter formulas to solve multiplicative comparison problems.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may incorrectly use the area and perimeter formulas. • Student may overgeneralize or under generalize the definition of area and/or perimeter situations. For example, o Student interprets all "wall painting" problems as area, even if the problem talks about the length of a striped border that is painted around the room. o Student interprets all "fence" problems as perimeter, even if the problem talks about the size of the garden that the fence encloses.	Error Analysis, Mystery Dimension, Compound Shape Challenge, Practice, Check Your Understanding
	• Students may struggle to break a more complex shape into squares or rectangles in order to calculate area and perimeter. • Students may struggle to calculate missing side lengths in a complex shape (since not everything is labeled). • Students may miscalculate perimeter if there is an overlapping side in a complex shape. They may add all sides to find perimeter but not recognize that some sides are within the irregular shape.	Calculating Crazy Shapes, Writing About Math, Practice, Check Your Understanding
	• Students may not realize that multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other. • Students may think that all shapes with a given perimeter have the same area or that all shapes with a given area have the same perimeter.	Big Ants, Small Ants, Picnic at the Park, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to area and perimeter.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may confuse area and perimeter. • Students may overgeneralize or under generalize the definition of area and/or perimeter situations. For example, o Students may not realize that multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other. o Students may think that all shapes with a given perimeter have the same area or that all shapes with a given area have the same perimeter.	

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LESSON 1
Marching Ants

Lesson Overview

In this lesson, students review how to find the perimeter of a rectangle with visual models and learn and apply the formula for calculating perimeter. They review the definition of a quadrilateral and discuss why a square is a special type of rectangle. They apply their understanding to story problems.

Lesson Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

Learning Objectives

In this lesson

- Students will define perimeter.
- Students will use formulas to calculate the perimeter of rectangles.
- Students will explain how to calculate perimeter.

Grade-Level Standards

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

formula, length, perimeter, quadrilateral, scale, sum, width

Materials List

- Large version of the Perimeter Formulas for Rectangles anchor chart

Perimeter Formulas for Rectangles

$P = 2l + 2w$
$P = l + l + w + w$
$P = 2 \times (l + w)$
$P = 4s$ (Square only, where s = side)

- Thinking Like a Mathematician anchor chart

DIGITAL



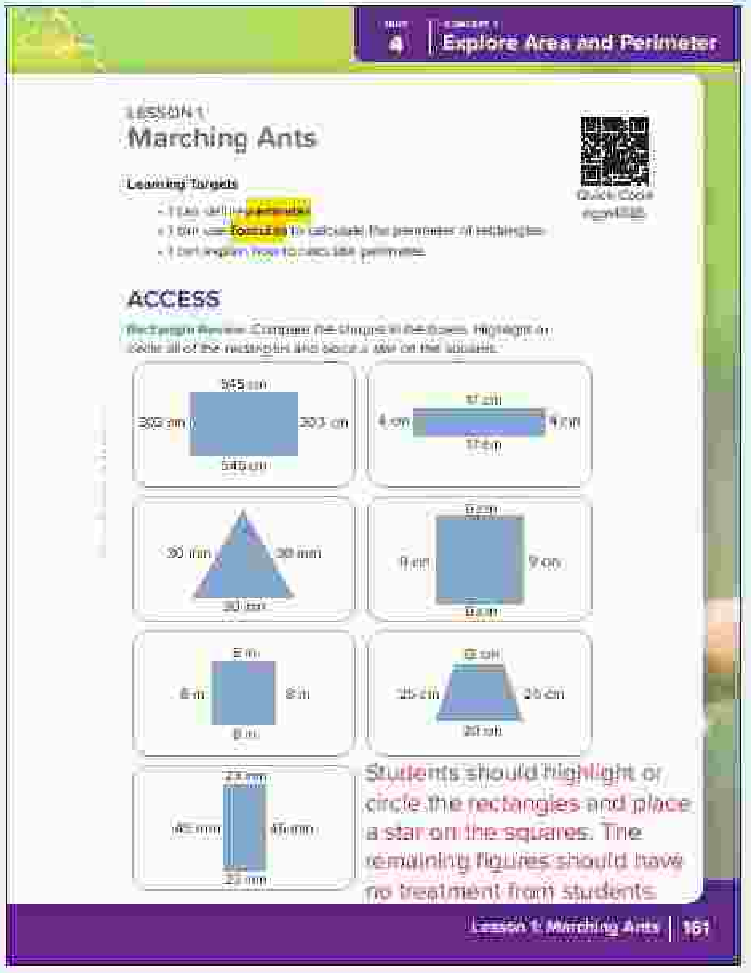
Lesson 1
Marching Ants

Quick Code: egmt4085

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Unit 4 | Concept 1 Explore Area and Perimeter

LESSON 1

Marching Ants

Quick Code

Learning Targets

- I can define perimeter.
- I can use formulas to calculate the perimeter of rectangles.
- I can explain how to calculate perimeter.

ACCESS

Rectangle Review: Compare the shapes in the boxes. Highlight or circle all of the rectangles and place a star on the squares.

Students should highlight or circle the rectangles and place a star on the squares. The remaining figures should have no treatment from students.

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may confuse unit names for area and perimeter by using unit squares instead of units.
- Students may think that perimeter is the sum of the length and the width because area is the product of length and width.

Rectangle Review

1. Ask students to turn to Lesson 1 ACCESS Rectangle Review and complete the activity.
2. Tell students that the images drawn in their Student Editions are models that are not drawn to scale. That means that the measurements on the squares are not accurate. They are representative of larger measures that we could not print on paper. They need to pay attention to the measurements and labels on each side.
3. Engage students' prior knowledge by asking questions about shapes, such as:

ASK

- *How are rectangles and squares similar?*
- *How are rectangles and squares different?*
- *Can a square be a type of rectangle? Why or why not?*
- *Is a rectangle always a square? Why or why not?*
- *How would you define a rectangle?*
- *How would you define a square?*

Students should know that a rectangle is a quadrilateral (four-sided shape) with four sides and four corners. Each corner makes a right (90-degree) angle. Students should recognize that a square is a type of rectangle, but with other properties such as "four equal sides." This will help them understand that the formula $P = 4s$ is unique to a square in the next part of the lesson.

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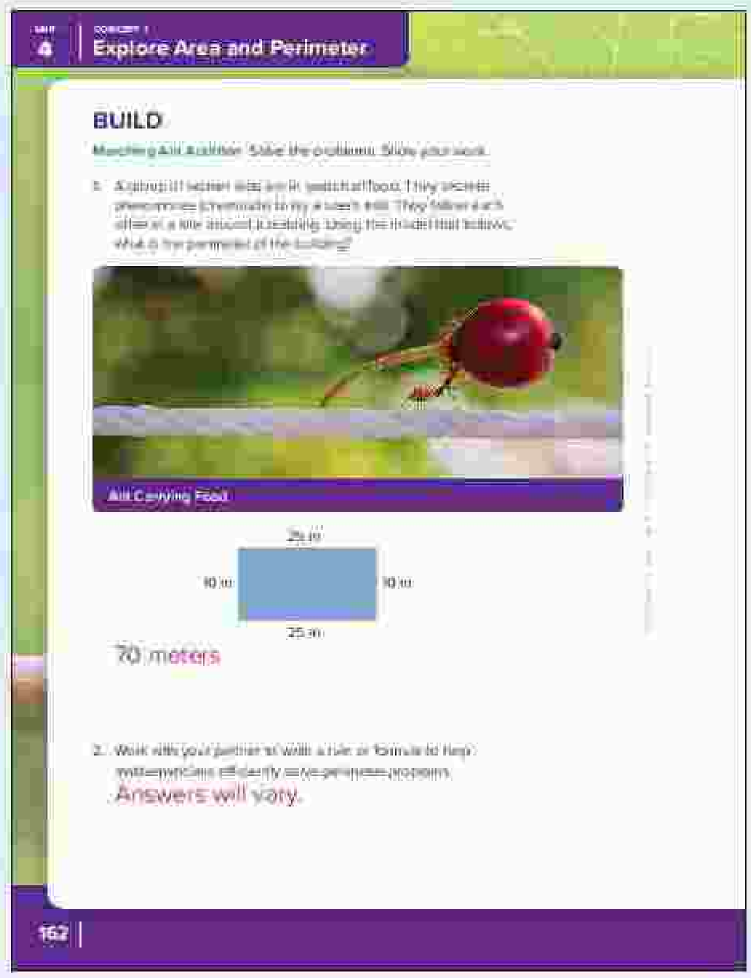
BUILD (40 min)

Marching Ant Addition (20 min)

1. Direct students to turn to Lesson 1 BUILD Marching Ant Addition. Chorally read the Learning Targets and ask students to do a Fist-to-Five to self-assess what they remember about perimeter.
2. Use Calling Sticks to choose a few students to share what they remember about perimeter. Reinforce that perimeter is the distance around a shape.
3. Tell students that a formula is a mathematical rule or relationship, expressed in symbols or letters, that can be used to solve any problem. Formulas often make problem-solving more efficient.
4. Ask students to solve Problem 1 in their Student Edition. Tell students to remember how they solved the problem so they can explain it.
5. After a few minutes, ask students to discuss their problem-solving strategy and answer with their Shoulder Partner. Ask volunteers to share their strategies with the class.
6. Ask students to work with their partner to solve Problem 2.
7. After a few minutes, ask volunteers to share the formula they created. Record all formulas and discuss students' ideas as a class.

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4 | Explore Area and Perimeter

BUILD

Ant Carrying Food

25 m
10 m
10 m
25 m

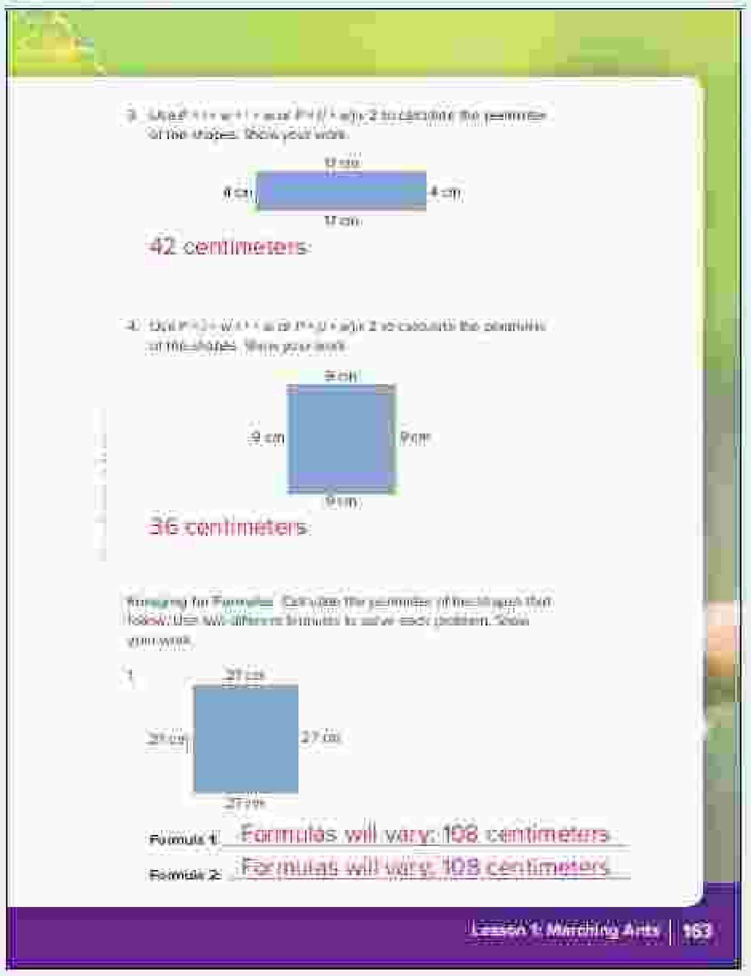
70 meters

Answers will vary.

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3\. 17 cm / 4 cm / 4 cm / 17 cm

42 centimeters

4\. 9 cm / 9 cm / 9 cm / 9 cm

36 centimeters

1\. 27 cm / 27 cm / 27 cm / 27 cm

Formula 1: Formulas will vary; 108 centimeters

Formula 2: Formulas will vary; 108 centimeters

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8. Write the formula $P = l + w + l + w$ on the board. Explain that the P stands for perimeter, the l for length, and the w for width. Ask students to compare the perimeter formula to their own formulas.
9. Ask students to solve Problems 3 and 4.
10. Ask volunteers to show their work on the board. Ask students if any of them added the numbers in a different order. Did they get the same answer? Why? Reinforce that when we calculate perimeter, the order in which we add the sides does not matter.

Foraging for Formulas (20 min)

1. Ask students to look again at Problems 3 and 4. Challenge students to come up with a formula for perimeter that uses multiplication.
2. Give students a few minutes to explore strategies. Ask students to share what they discovered. Record their strategies on the board. For each strategy, ask students if it would work every time and if the strategy is efficient. Discuss.
3. Introduce the Perimeter Formulas for Rectangles anchor chart. Ask students to compare what they discovered with the formulas on the poster. Clarify any misconceptions or confusion.

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4. Reinforce that there are several formulas to calculate perimeter for rectangles. The last formula on the anchor chart only works on squares since the sides are all the same length. Remind students that we can always add to calculate perimeter.

5. Direct students to complete Problems 1–4 in Lesson 1 BUILD Foraging for Formulas. Remind students that they will need to try at least two different formulas from the anchor chart to solve Problems 1–3.

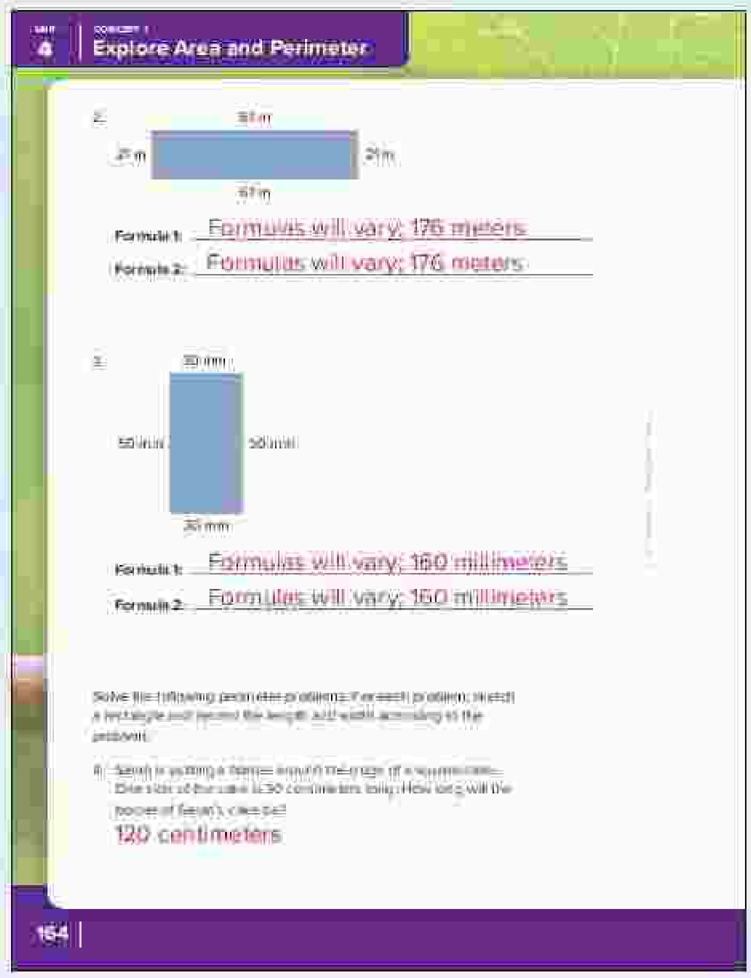
6. During the last 2–3 minutes of BUILD, review the answers as a class. Ask students to discuss the efficiency of the strategies they tried.

Answer Key for Foraging for Formulas:

1. 108 centimeters
2. 176 meters
3. 160 millimeters
4. 120 centimeters
5. 346 meters

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UNIT 4 | CONCEPT 1
Explore Area and Perimeter

2. (rectangle: 67 m, 21 m, 21 m, 67 m)

Formula 1: Formulas will vary; 176 meters

Formula 2: Formulas will vary; 176 meters

3. (rectangle: 30 mm, 50 mm, 50 mm, 30 mm)

Formula 1: Formulas will vary; 160 millimeters

Formula 2: Formulas will vary; 160 millimeters

Solve the following perimeter problems. For each problem, sketch a rectangle and record the length and width according to the problem.

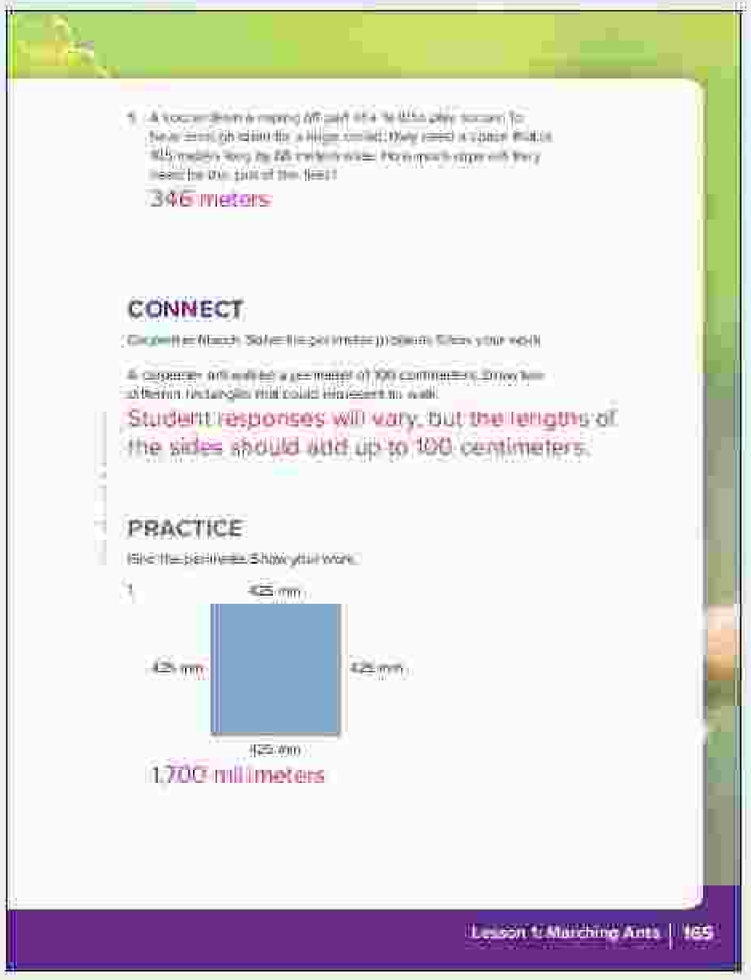
4. Sarah is putting a frame around the edge of a square cake. One side of the cake is 30 centimeters long. How long will the border of Sarah's cake be?

120 centimeters

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346 meters

CONNECT

Student responses will vary, but the lengths of the sides should add up to 100 centimeters.

PRACTICE

425 mm

1,700 millimeters

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CONNECT (7 min)

Carpenter March

1. Direct students to Lesson 1 CONNECT Carpenter March to read the problem.
2. Ask students how this type of problem is different than the other perimeter problems they have solved. Reinforce that the perimeter is given but the sides are not. Ask one or two students to share their thinking about possible strategies for determining the lengths of the sides.
3. Ask students to work independently to solve the problem.

   TEACHER NOTE: Consider using this activity as a formative assessment to determine which students need additional support.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to think about the statement from the Thinking Like a Mathematician anchor chart: I can use what I notice to explain rules and shortcuts when solving problems.
2. Ask students to talk to their Shoulder Partner to answer the following:

ASK

- *How is a formula a mathematical shortcut?*
- *Which perimeter formula do you think is most efficient and why?*

3. Use Calling Sticks to select students to share their thinking with the class.

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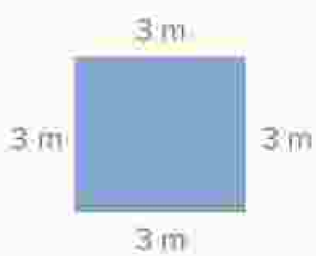
PRACTICE

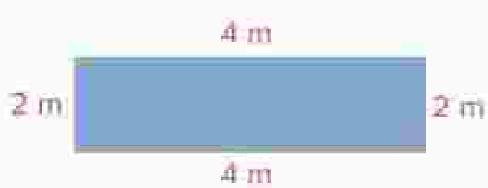
Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

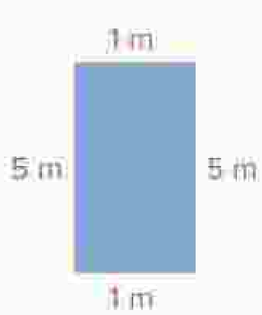
Check Your Understanding

Find the perimeter. Show your work.

1. 1,696 centimeters
2. 4,808 millimeters
3. Find the perimeter of each rectangle. Circle the larger rectangle and explain your thinking in the box below. Note that rectangles are not drawn to scale.
   1 = 386 centimeters
   2 = 386 millimeters
   Students should see that Rectangle 1 is the larger rectangle since it is measured in centimeters.
4. Adam built a goat fence. It has a perimeter of 12 meters. What are two possible ways it could be built?
   Sample responses include:

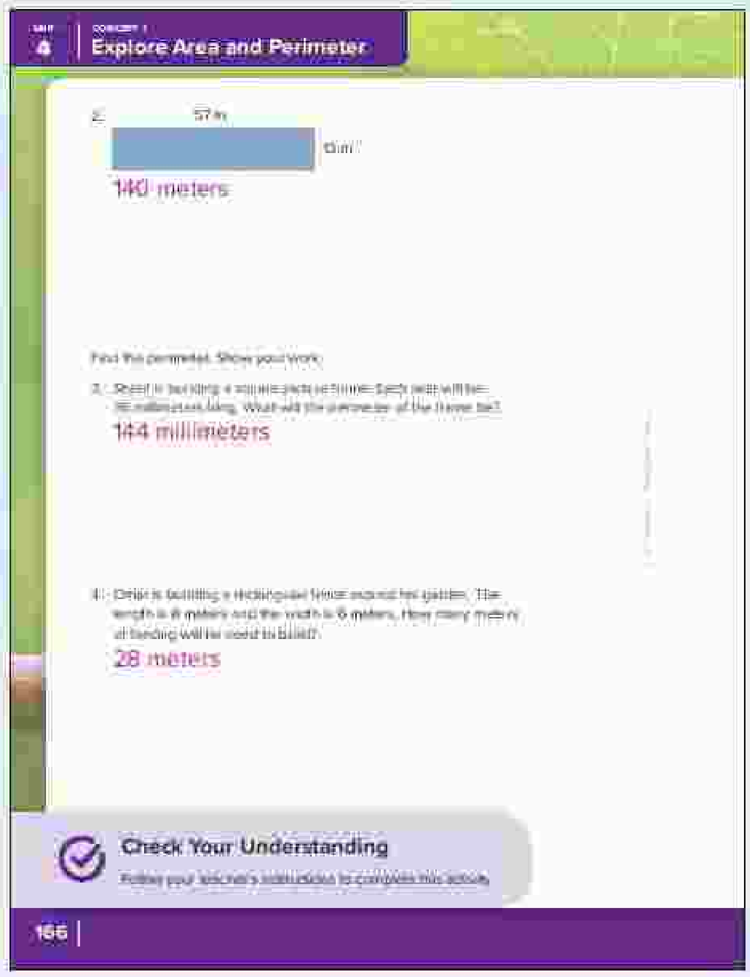






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UNIT 4 | CONCEPT 1 Explore Area and Perimeter

2.

140 meters

Find the perimeter. Show your work.

3.

144 millimeters

4.

28 meters

Check Your Understanding

166

Materials List

- Large version of the Area Formula for Rectangles anchor chart

> **Area Formula for Rectangles**
>
> $A = l \times w$

DIGITAL



Lesson 2

Fill the Space

Quick Code: egmt4086

LESSON 2
Fill the Space

Lesson Overview

In this lesson, students review how to find the area of a rectangle and then learn the formula. They calculate the area of shapes and apply that understanding to solve story problems. All problems can be solved using a variety of multiplication strategies and will use numbers under 12. Students also investigate the relationship between area and perimeter.

Lesson Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

Learning Objectives

In this lesson

- Students will define area.
- Students will use formulas to calculate the area of rectangles.
- Students will explain how to calculate area.

Grade-Level Standards

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

area, length, two-dimensional, width

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

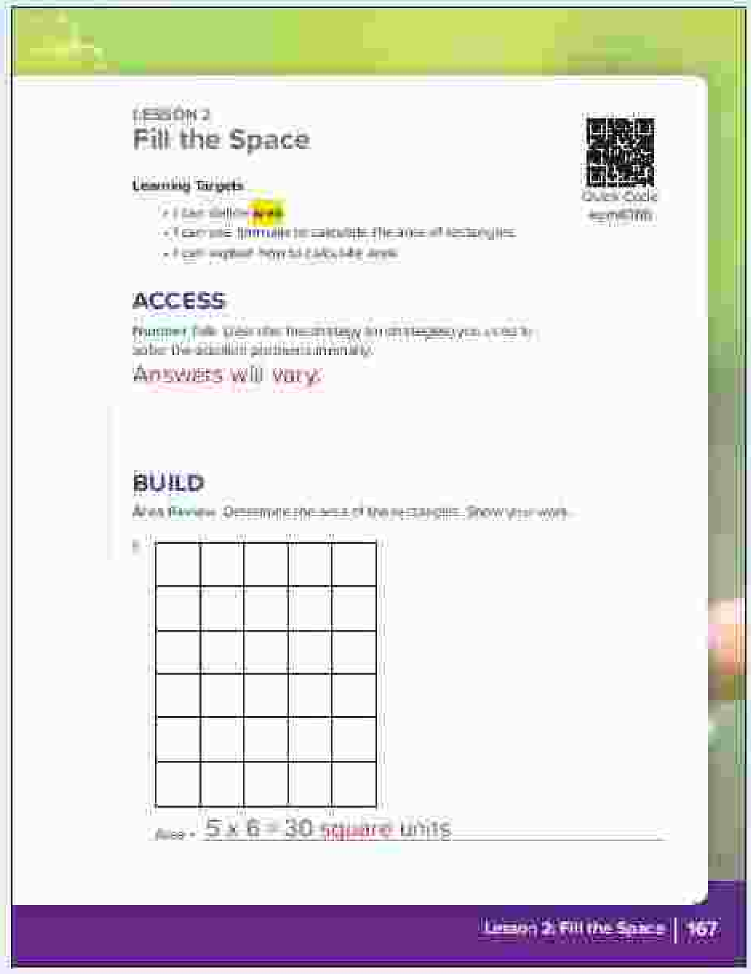
- Students may confuse unit names for area and perimeter by using units instead of square units.
- Students may confuse area and perimeter in both what the question is asking and by using an incorrect formula.

Number Talk

1. Explain to students that they will use benchmark numbers to solve addition problems.
2. Begin Number Talk:
   - Write a problem on the board.
   - Students think quietly and give a Thumbs-Up when they know the answer.
   - Give Wait Time so that all students have enough time to think about the problem.
   - Call on several students who have their Thumbs-Up and record their answers on the board.
   - Ask students to explain their thinking.
   - Record their thinking on the board so other students can see their strategies.
3. Work through the following problems:
   - 19 + 2; 19 + 5; 19 + 8; 19 + 12
   - 8 + 5; 8 + 13; 8 + 24; 18 + 7
   - 39 + 16; 28 + 39; 59 + 13; 23 + 49
   - 25 + 25; 25 + 26; 24 + 26; 26 + 49
4. With about 2 minutes left in ACCESS, ask students to turn to Lesson 2 ACCESS Number Talk and respond to the question.

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LESSON 2

Fill the Space

Learning Targets

- I can define area.
- I can use formulas to calculate the area of rectangles.
- I can explain how to calculate area.

Quick Code

ACCESS

Number Talk: Describe the strategy or strategies you used to solve the addition problems mentally.

Answers will vary.

BUILD

Area Review: Determine the area of the rectangles. Show your work.

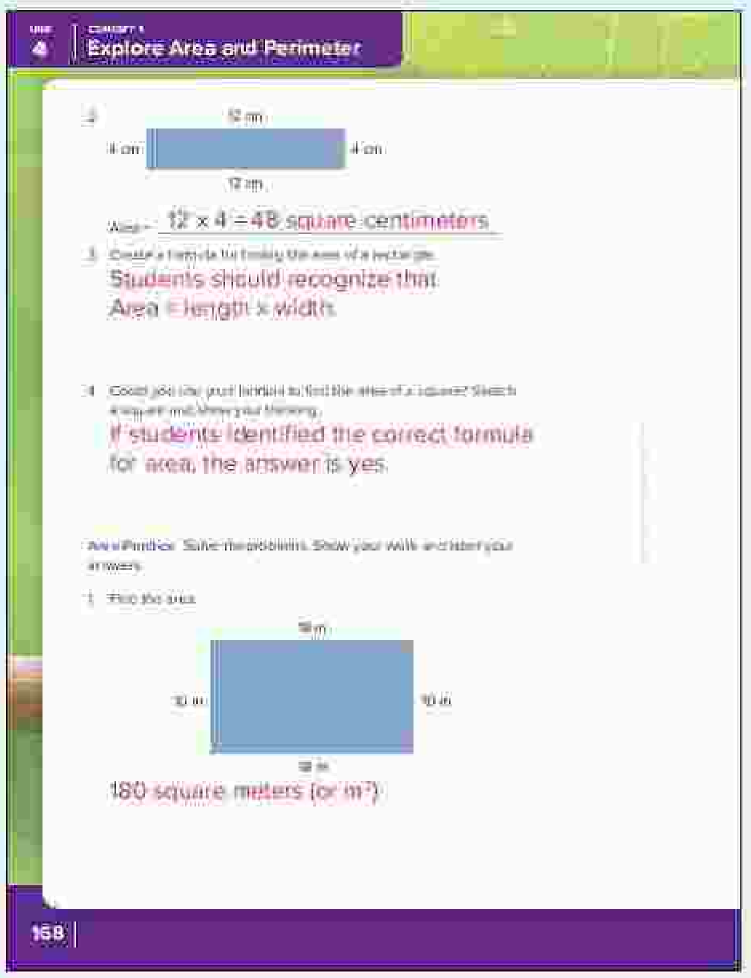
Area = 5 x 6 = 30 square units

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Unit 4 | Concept 1
Explore Area and Perimeter

2.

Area = 12 × 4 = 48 square centimeters

3. Create a formula for finding the area of a rectangle.

Students should recognize that Area = length × width.

4. Could you use your formula to find the area of a square? Sketch a square and show your thinking.

If students identified the correct formula for area, the answer is yes.

Area Practice Solve the problems. Show your work and label your answers.

1. Find the area.

180 square meters (or m^2)

168

TEACHER NOTE This Number Talk is organized to use numbers that are 1 away from a benchmark, or friendly, number. For instance, 19 + 5 is an opportunity for students to decompose the problem and make it 20 + 4. Looking for benchmarks makes it easier for students to develop their mental math skills. Consider using the written portion of the activity as a formative assessment to determine which students may need additional practice using benchmark numbers in mental math.

BUILD (40 min)

Area Review (25 min)

1. Direct students to Lesson 2 BUILD Area Review and ask students to chorally read the Learning Targets. Using a Fist-to-Five, ask students to reflect first on what they remember about the definition of area, and second about how to find the area of a rectangle.
2. Use Calling Sticks to select students to share their thinking. Clear up any misconceptions and remind students that the area of a shape is the surface space of a two-dimensional shape. Help students generate ideas for examples of shapes they could find the area of, such as the top of a desk, the classroom floor, a playground, or the cover of a book.
3. Using the examples given by students, discuss the difference between area and perimeter. For example, we would use area to measure the amount of floor space in the classroom, and we would use perimeter to find the distance around the classroom.
4. Direct students to Lesson 2 BUILD Area Review to determine the area of the rectangle in Problem 1.
5. Give students a few minutes to try and solve the problem. Then ask them to raise their hands and share their strategy and solution.

   TEACHER NOTE Some students may have counted one set of boxes across and down and realized the rectangle was a 5 × 6 array. Other students may have counted all the boxes using one-to-one correspondence.

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6. Remind students that area is always measured in square units. It is called square units because we are filling in the rectangular space with squares that have two dimensions: length and width. It can be any unit of length—millimeters, centimeters, meters, kilometers—but we always say squared or write an exponent of 2 to represent the amount of squares of a specific unit that can be drawn in a grid on the shape.
7. Ask students to solve Problems 2–4.
8. After 5–7 minutes, call on several students to share the formulas they wrote with the class.
9. Display the Area Formula for Rectangles anchor chart. Ask students to compare their formulas to the one on the anchor chart. Reinforce that the formula used to find the area of a rectangle is $A = l \times w$.

   TEACHER NOTE: If students struggle with multiplication facts, show them how they can draw a grid inside a rectangle to help them solve for area. Another strategy that can be reviewed is using partial products to help break down larger numbers into numbers that are easier to work with. For example, an 8 × 12 rectangle can be broken into an 8 × 10 rectangle and an 8 × 2 rectangle.

Answer Key for Area Review:

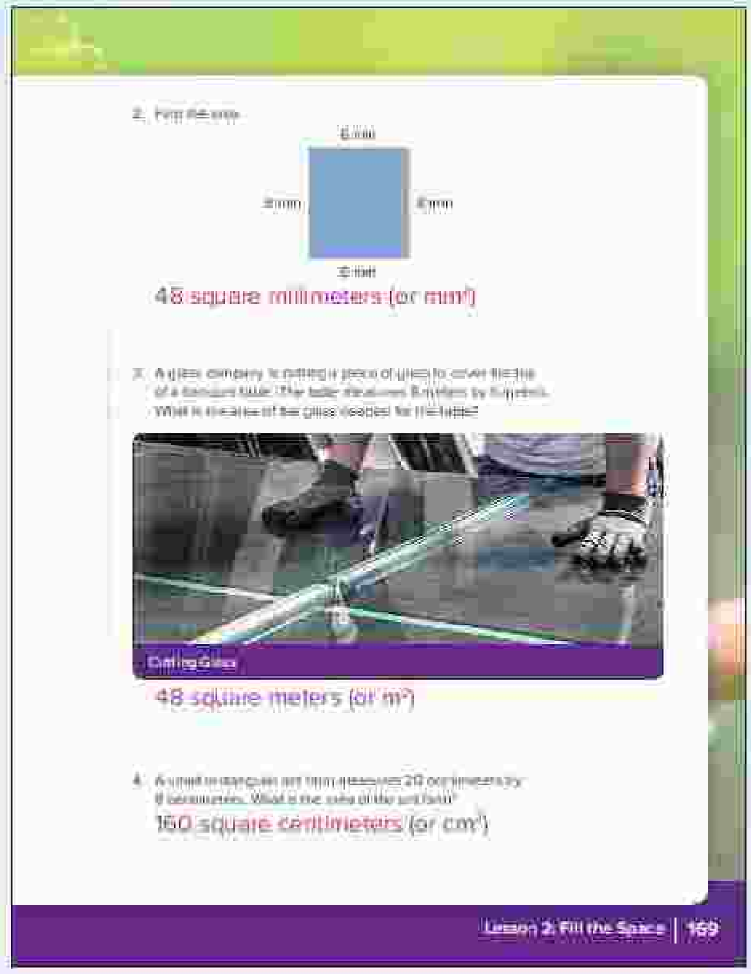
1. 30 square units
2. 48 square centimeters
3. Students should recognize that Area = length × width.
4. If students identified the correct formula for area, the answer is yes.

Area Practice (15 min)

1. Direct students to Lesson 2 BUILD Area Practice. Ask students to work independently to solve the problems. Students who finish early should try the Challenge problem.
2. When there are 3 minutes left in BUILD, go over the answers with the class. Discuss any problems students might have struggled with or they felt proud to be able to solve. Ask students to share their problem-solving strategies.

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Unit 4 | Concept 1
Explore Area and Perimeter

5. **Challenge:** [illegible]

What is the measurement of the frame? Should you calculate area or perimeter to find the measurement?

Perimeter (frame) = 28 meters

What is the measurement of the glass? Should you calculate area or perimeter to find the measurement?

Area (glass) = 24 square meters

CONNECT

Carpet Tile: Solve the problem. Show your work.

You have 36 square carpet tiles to arrange on the floor in the shape of a rectangle. Show two possible arrangements and label the length and width. What is the perimeter of each arrangement? What is the area?

Answers will vary. The area of each rectangle should be 36 square carpet tiles, but the perimeter will differ depending on the length and width of each rectangle.

PRACTICE

For each problem, find the area and perimeter. Show your work and label your answers.

1. For a science project two students are creating an ant farm enclosure. Their enclosure will be 5 meters long and 2 meters wide. Sketch the enclosure and label the dimensions. Then, find the perimeter and area.

Accept any sketch showing a 5 meters x 2 meters rectangle. Perimeter = 14 meters
Area = 10 square meters

170

Answer Key for Area Practice:

1. 180 square meters (or m^2)
2. 48 square millimeters (or mm^2)
3. 48 square meters (or m^2)
4. 160 square centimeters (or cm^2)
5. **Challenge:** Perimeter (frame) = 28 meters; Area (glass) = 24 square meters

CONNECT (7 min)

Carpet Tile

1. Ask students to solve the problem in Lesson 2 CONNECT Carpet Tile.
2. If time permits, ask students to share their solutions with the class.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Direct students to talk to their Shoulder Partner to answer the essential question: How are area and perimeter related?
2. Use Calling Sticks to select students to share their thinking with the class.

TEACHER NOTE: This can act as a formative assessment to determine if students are confident in explaining the differences between these two types of measurement.

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PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions.

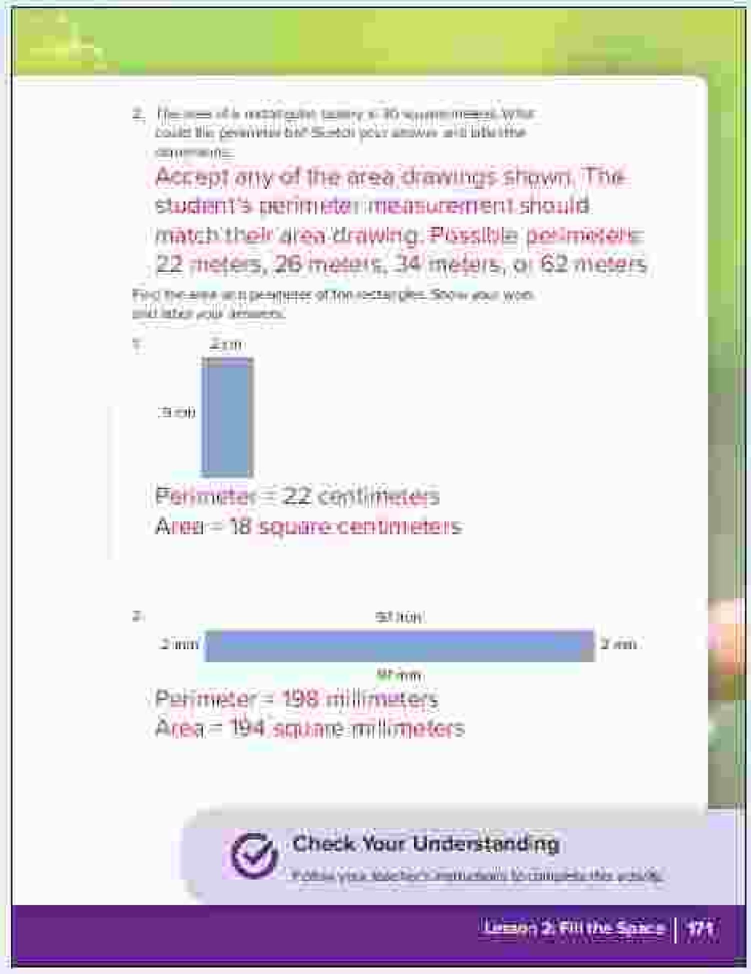
Check Your Understanding

For each problem, find the area and perimeter. Show your work and label your answers.

1. A = 49 square meters; P = 28 meters
2. A = 48 square centimeters; P = 32 centimeters
3. Solve the problem. Show your work and label your answers.
   Omar's family is redecorating their dining room. The room is a rectangle that measures 4 meters long and 3 meters wide. How many square meters of carpet will they need for the floor? How many meters of trim will they need to trace the border of the ceiling?
   A = 12 square meters of carpet
   P = 14 meters of trim

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Accept any of the area drawings shown. The student's perimeter measurement should match their area drawing. Possible perimeters: 22 meters, 26 meters, 34 meters, or 62 meters

Perimeter = 22 centimeters
Area = 18 square centimeters

Perimeter = 198 millimeters
Area = 194 square millimeters

Check Your Understanding

Lesson 2: Fill the Space | 171

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Materials List

- Unit 4 Lesson 3 SCOOT cards (1 card per pair of students)
- Unit 4 Lesson 3 SCOOT answer key (At the end of the volume)

Preparation

Photocopy the Blackline Master at the end of the volume.

Photo Credit: Robert Gregory Griffeth / Shutterstock.com

DIGITAL



Lesson 3

Something Is Missing!

Quick Code: egmt4087

LESSON 3
Something Is Missing!

Lesson Overview

In this lesson, students apply area and perimeter formulas to solve for an unknown dimension in a rectangle or a square. The dimensions for the problems in this lesson go slightly higher than 10, so adjust the numbers as needed if students struggle with the multiplication.

Lesson Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

Learning Objective

In this lesson

- Students will use formulas to calculate unknowns when given some dimensions of rectangles.

Grade-Level Standards

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

area, dimensions, formula, perimeter, unknown

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may incorrectly use the area and perimeter formulas.
- Students may overgeneralize or under generalize the definition of area and/or perimeter situations. For example,
  - Student interprets all "wall painting" problems as area, even if the problem talks about the length of a striped border that is painted around the room.
  - Student interprets all "fence" problems as perimeter, even if the problem talks about the size of the garden that the fence encloses.

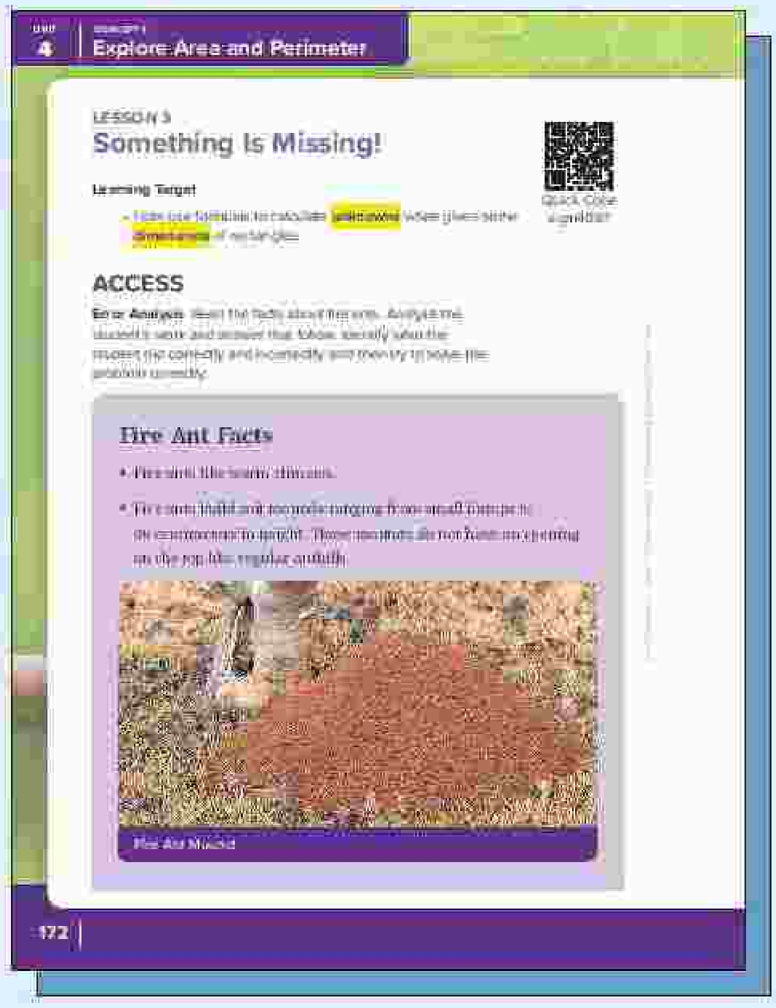
Error Analysis

1. Direct students to Lesson 3 ACCESS Error Analysis. Ask volunteers to read the directions and the problem aloud. Ask students to work independently to complete the error analysis.
2. After about 5 minutes, go over the answers to the error analysis.
3. If time allows, ask students to think of how they could reword the question so that the student could solve for the perimeter.

Answer Key for Error Analysis:
Students should note that the student incorrectly solved for the perimeter when the question asked for finding the area of ground inside the string, therefore the area enclosed. Reinforce the definition and formulas for area and perimeter. The correct answer is 96 square meters.

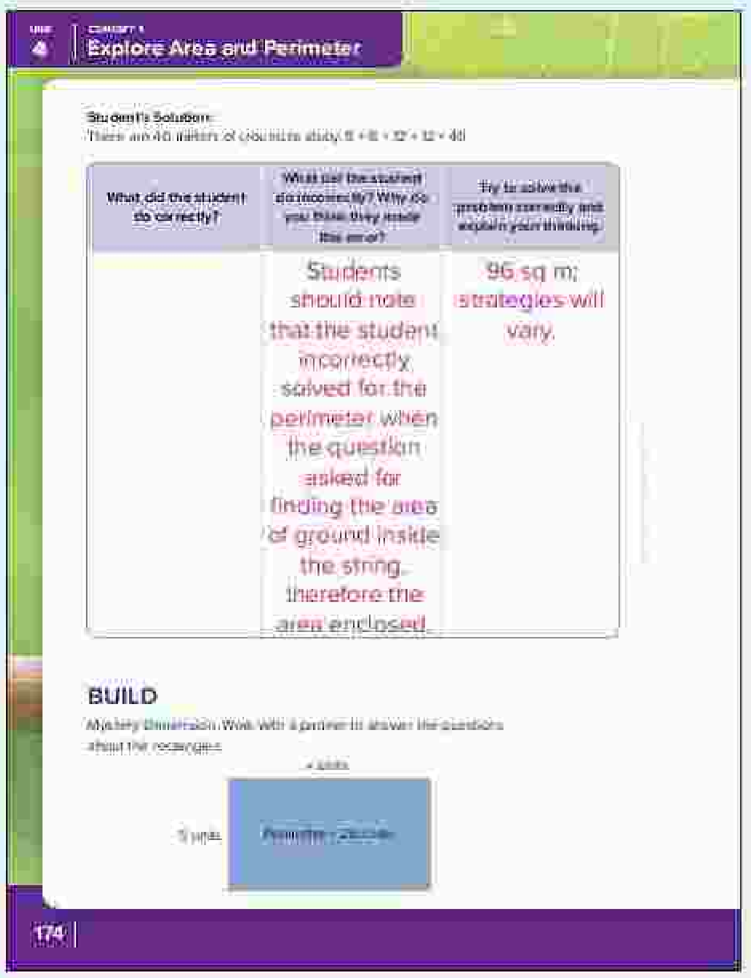
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Unit 4 | Explore Area and Perimeter

Student's Solution:

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly and explain your thinking.
	Students should note that the student incorrectly solved for the perimeter when the question asked for finding the area of ground inside the string, therefore the area enclosed.	96 sq m; strategies will vary.

BUILD

174

BUILD (40 min)

Mystery Dimension (25 min)

1. Direct students to Lesson 3 BUILD Mystery Dimension. Ask students to read the Learning Target silently as you read it aloud. Explain that today they are going to use their understanding of the area and perimeter formulas to solve for unknown dimensions.
2. Ask students to examine the first rectangle in their Student Edition. Direct students to work with their Shoulder Partner to complete Problems 1–3.
3. After a few minutes, ask students to explain their thinking using one of the perimeter formulas.
4. Ask for a volunteer to remind the class of the formula for area.
   (Area = length × width)
5. Ask students to solve Problems 4–6 and raise their hand when they know the area of the rectangle.
6. Ask students to think about how this problem is different than the last one and give a Thumbs-Up when they are ready to share. Ask volunteers to share their thinking with the class.
   Reinforce that we have an unknown dimension again, but this time we are working with area instead of perimeter.

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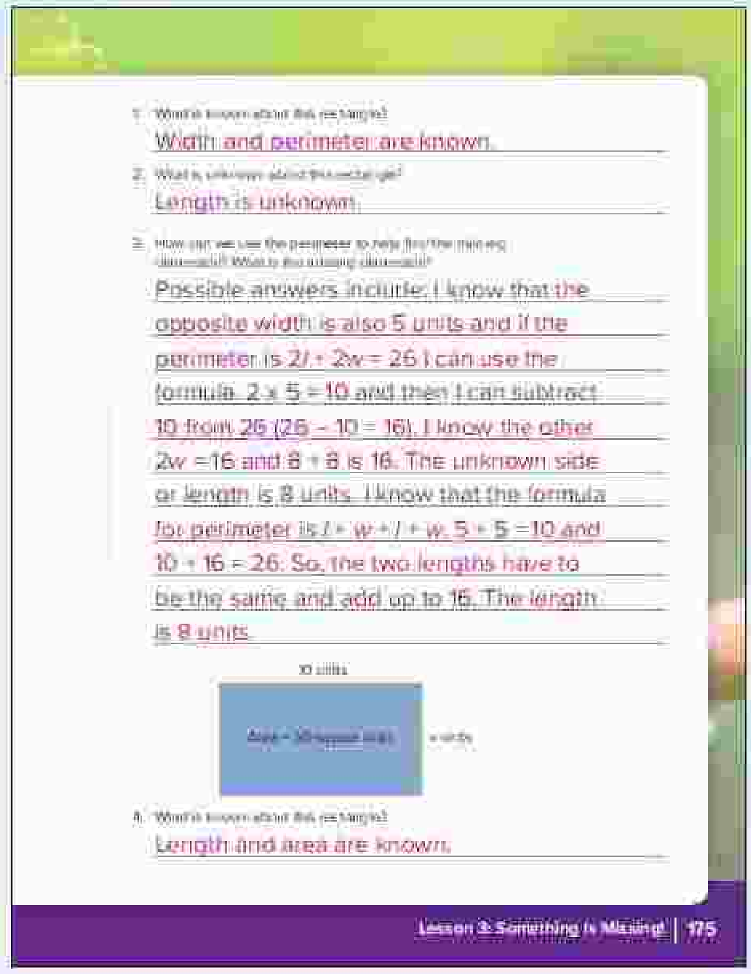
7. After a few minutes, ask volunteers to share their solutions and problem-solving strategies.

Answer Key for Mystery Dimension:

1. Width and perimeter are known.
2. Length is unknown.
3. Possible answers include: I know that the opposite width is also 5 units and if the perimeter is $2l + 2w = 26$ I can use the formula. $2 \times 5 = 10$ and then I can subtract 10 from 26 $(26 - 10 = 16)$. I know the other $2w = 16$ and $8 + 8$ is 16. The unknown side or length is 8 units. I know that the formula for perimeter is $l + w + l + w$. $5 + 5 = 10$ and $10 + 16 = 26$. So, the two lengths have to be the same and add up to 16. The length is 8 units.
4. Length and area are known.
5. Width is unknown.
6. Possible answers include: I can use the area formula. 50 square units is equal to 10 units times the width. 10 times 5 equals 50, so the width is 5 units. The area formula says $50 = 10 \times$ ______. I can solve that with division. So, 50 square units divided by 10 units is 5 units.

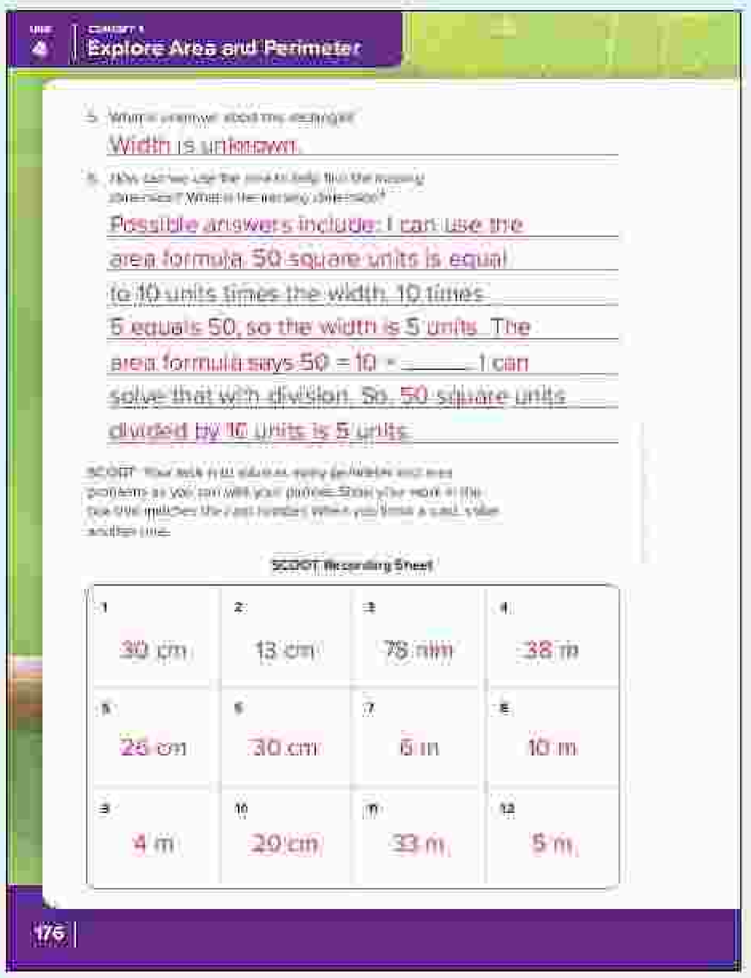
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Width and perimeter are known.
Length is unknown.
Possible answers include: I know that the opposite width is also 5 units and if the perimeter is $2l + 2w = 26$ I can use the formula. $2 \times 5 = 10$ and then I can subtract 10 from 26 $(26 - 10 = 16)$. I know the other $2w = 16$ and $8 + 8$ is 16. The unknown side or length is 8 units. I know that the formula for perimeter is $l + w + l + w$. $5 + 5 = 10$ and $10 + 16 = 26$. So, the two lengths have to be the same and add up to 16. The length is 8 units.
Length and area are known.
Lesson 3: Something Is Missing! | 175

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Unit 4 | Explore Area and Perimeter

Width is unknown.

Possible answers include: I can use the area formula. 50 square units is equal to 10 units times the width. 10 times 5 equals 50, so the width is 5 units. The area formula says 50 = 10 × ______. I can solve that with division. So, 50 square units divided by 10 units is 5 units.

SCOOT Recording Sheet

1	2	3	4
30 cm	13 cm	78 mm	38 m
5	**6**	**7**	**8**
26 cm	30 cm	6 m	10 m
9	**10**	**11**	**12**
4 m	20 cm	33 m	5 m

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SCOOT (15 min)

1. Explain to students that they will use the last 10 minutes of BUILD to solve more missing dimension problems.
2. Ask students to turn to Lesson 3 BUILD SCOOT. Introduce the SCOOT activity (depending on how you have set up the game):
    - Twelve cards, each labeled with a number and containing a perimeter or area problem, are placed around the room (or distributed to partners).
    - Students work with their partner to solve the problems. They should show their work in the box that matches their card number.
    - When finished, pairs move to another card (or swap cards with another team).
    - The goal is to solve as many SCOOT card problems as possible.

    TEACHER NOTE If space is limited, distribute a card to each pair of students and have them swap cards with nearby students when finished. As students play SCOOT, walk around the room to observe how students find the missing dimensions. If the cards are placed around the room, take note of students who choose to solve the Challenge cards. Identify students who may need additional support and practice.

3. With a few minutes left in BUILD, go over the answers with students (see the SCOOT answer key).

Answer Key for SCOOT:

1. 30 centimeters
2. 13 centimeters
3. 78 millimeters
4. 38 meters
5. 26 centimeters
6. 30 centimeters
7. 6 meters
8. 10 meters
9. 4 meters
10. 20 centimeters
11. 33 meters
12. 5 meters

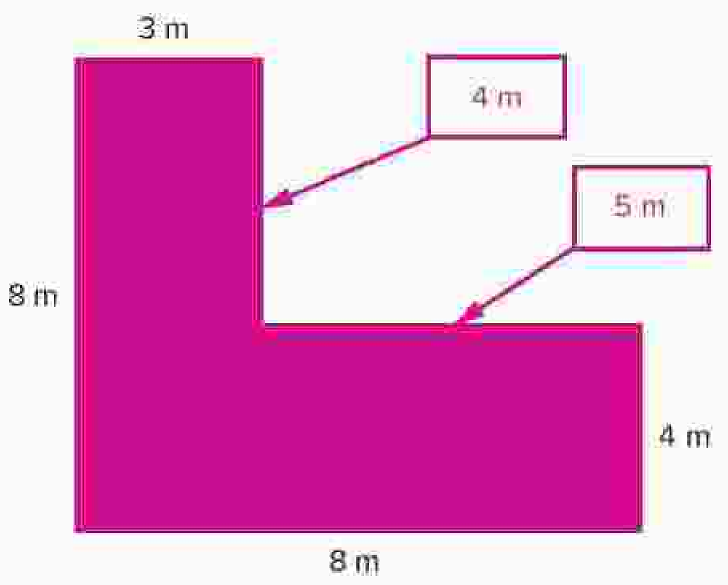
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CONNECT (7 min)

Compound Shape Challenge

1. Remind students of the facts they learned about fire ants at the beginning of the lesson. Ask a few students to share their favorite ant fact.
2. Ask students to turn to Lesson 3 CONNECT Compound Shape Challenge. Ask volunteers to read the directions and the problem aloud.
3. After 5 minutes, use Calling Sticks to choose two or three students to share how they solved the problem.

Answer Key for Compound Shape Challenge:



Perimeter = 32 meters
Area = 44 square meters

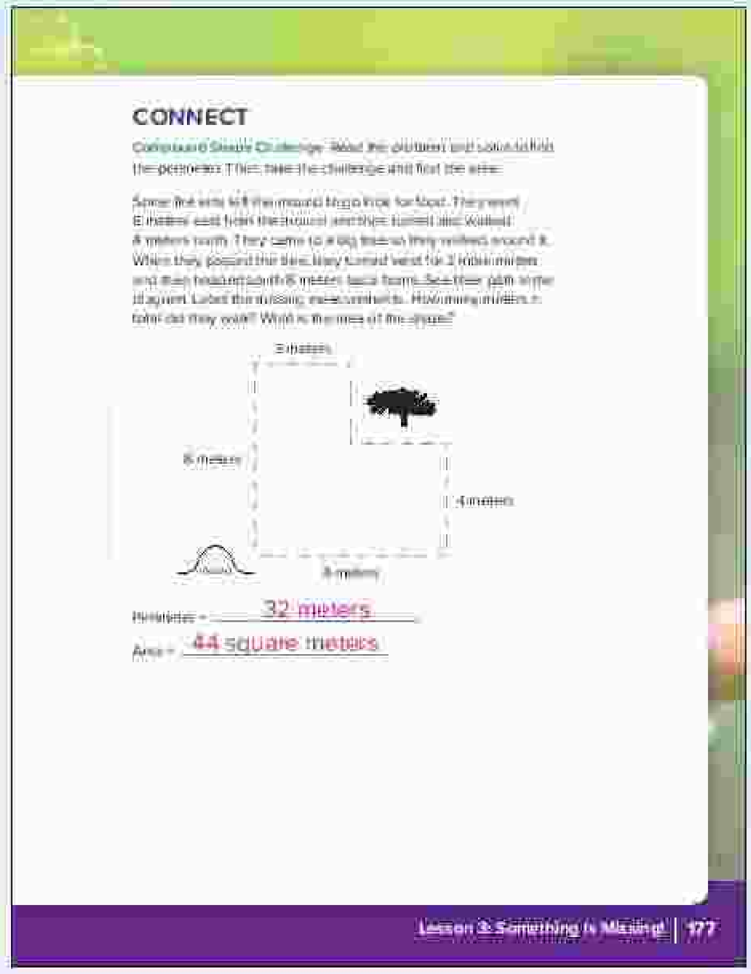
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss the following questions:

ASK
- *What are some real-world applications for finding perimeter and area?*
- *When would you need to find area or the perimeter in your everyday life?*

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CONNECT

3 meters
8 meters
4 meters
8 meters

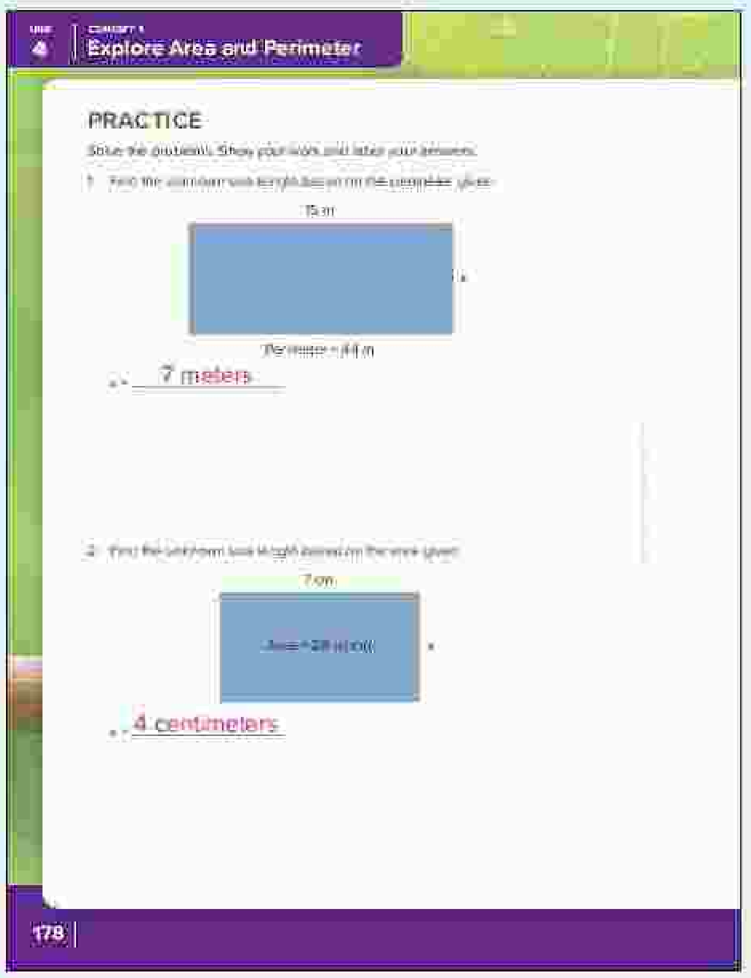
Perimeter = 32 meters
Area = 44 square meters

Lesson 3: Something Is Missing! | 177

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UNIT 4 | CONCEPT 1 Explore Area and Perimeter

PRACTICE

Solve the problems. Show your work and label your answers.

1. Find the unknown side length based on the perimeter given.

15 m

Perimeter = 44 m

x = 7 meters

2. Find the unknown side length based on the area given.

7 cm

Area = 28 sq cm

x = 4 centimeters

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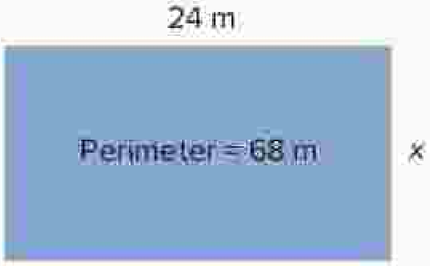
PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

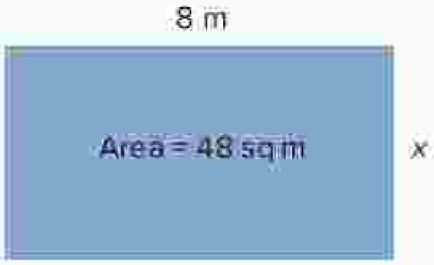
Solve the problems. Show your work and label your answers.

1. Find the unknown side length based on the given perimeter.



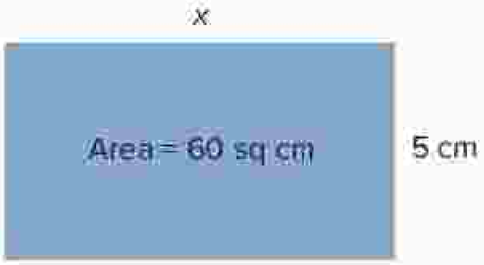
x = 10 meters

2. Find the unknown side length based on the given area.



x = 6 meters

3. Find the unknown side length based on the given area.



x = 12 centimeters

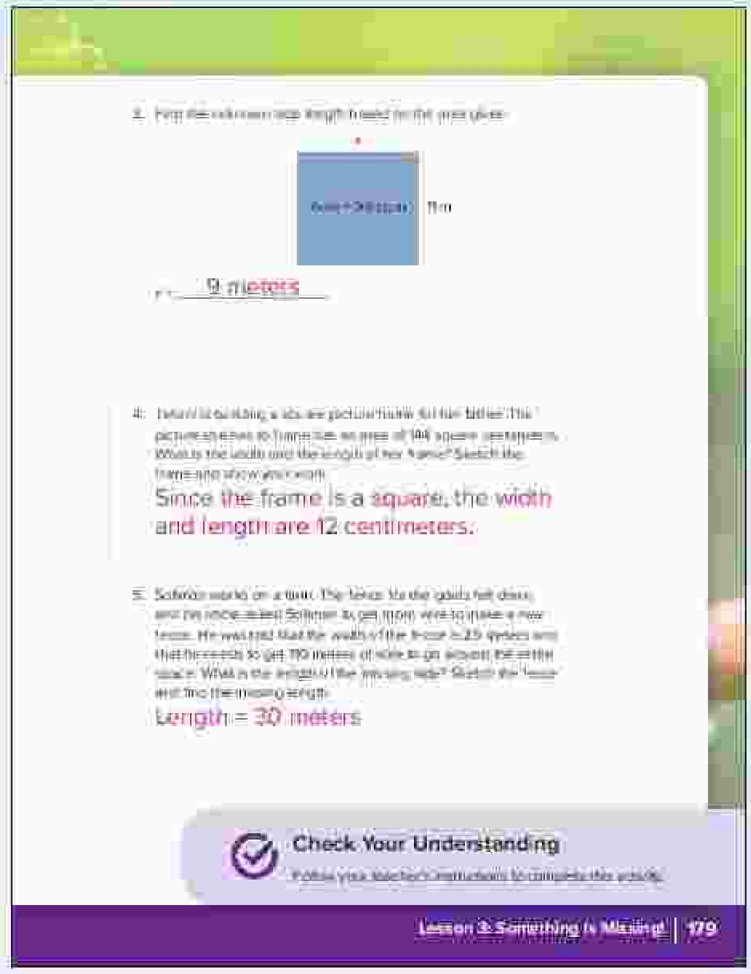
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4. Mazen wants to build a new enclosure for his goats. The area of the new enclosure will be 84 square meters. He knows that one side of his enclosure will be 12 meters long, but needs to figure out how wide it should be to complete the enclosure. Draw a sketch of the goat enclosure and determine the width in meters.
   Width = 7 meters

5. Nahed wants to put a ribbon border around a blanket she is making. The width of the blanket is 3 meters. The perimeter of the blanket is 16 meters. How long are the long sides of the blanket? Draw a sketch of the blanket and calculate the length of the long sides of the blanket.
   Length = 5 meters

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9 meters

Since the frame is a square, the width and length are 12 centimeters.

Length = 30 meters

Check Your Understanding

Lesson 3: Something Is Missing! | 179

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Materials List

- Unit 4 Lesson 4 Shape Cards (1 card per student)
- Scissors
- Tape

Preparation

Photocopy and cut apart cards.

DIGITAL



Lesson 4

Odd Shapes

Quick Code: egmt4088

LESSON 4
Odd Shapes

Lesson Overview

In this lesson, students learn and apply strategies for calculating the area and perimeter of complex shapes. Students use a variety of strategies to break shapes down into squares and rectangles to calculate their measurements.

Lesson Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

Learning Objectives

In this lesson

- Students will calculate the area and perimeter of complex shapes.
- Students will explain their strategies for finding the area and perimeter of complex shapes.

Grade-Level Standards

4.D.1 Solve problems involving measurement and conversion of measurements.

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

area, complex, perimeter

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

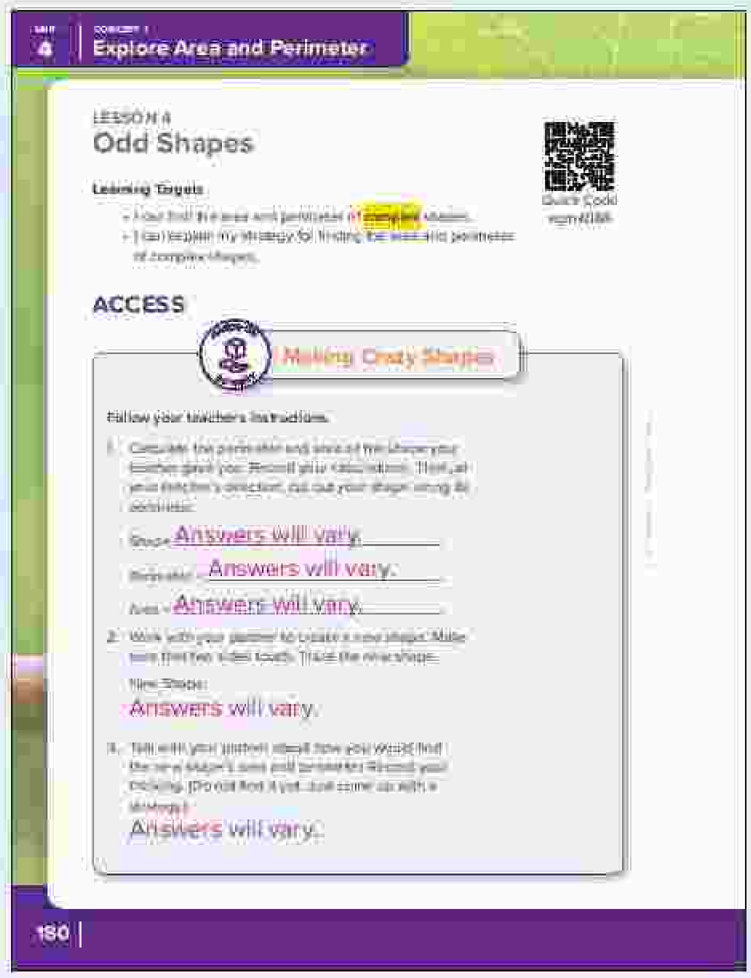
- Students may struggle to break a more complex shape into squares or rectangles in order to calculate area and perimeter.
- Students may struggle to calculate missing side lengths in a complex shape (since not everything is labeled).
- Students may miscalculate perimeter if there is an overlapping side in a complex shape. They may add all sides to find perimeter but not recognize that some sides are within the irregular shape.

Making Crazy Shapes

1. Direct students to Lesson 4 ACCESS Making Crazy Shapes and chorally read the Learning Targets.
2. Ask students to predict what is meant by the term complex shape.
   A complex shape is built from simple shapes like squares and rectangles.
3. Give each student one Lesson 4 Shape Card and ask students to calculate the area and perimeter of the shape on their card. Direct students to draw their shape in their Student Edition and label the dimensions.
4. Distribute (or ask students to take out) scissors and have students carefully cut out their shapes along the perimeter.
5. Ask students to work with a partner to put their two shapes together to create a unique shape.
6. Each partner should trace their new shape in Lesson 4 ACCESS Making Crazy Shapes and then talk to their partner about what they think they would do to calculate the area and perimeter of the new shape. (Students should not calculate yet.)
7. Use Calling Sticks to choose students to share their new shape and ideas for calculating the area and perimeter.

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UNIT 4 | CONCEPT 1
Explore Area and Perimeter

LESSON 4
Odd Shapes

Learning Targets
- I can find the area and perimeter of complex shapes.
- I can explain my strategy for finding the area and perimeter of complex shapes.

Quick Code

ACCESS

Making Crazy Shapes

Follow your teacher's instructions.

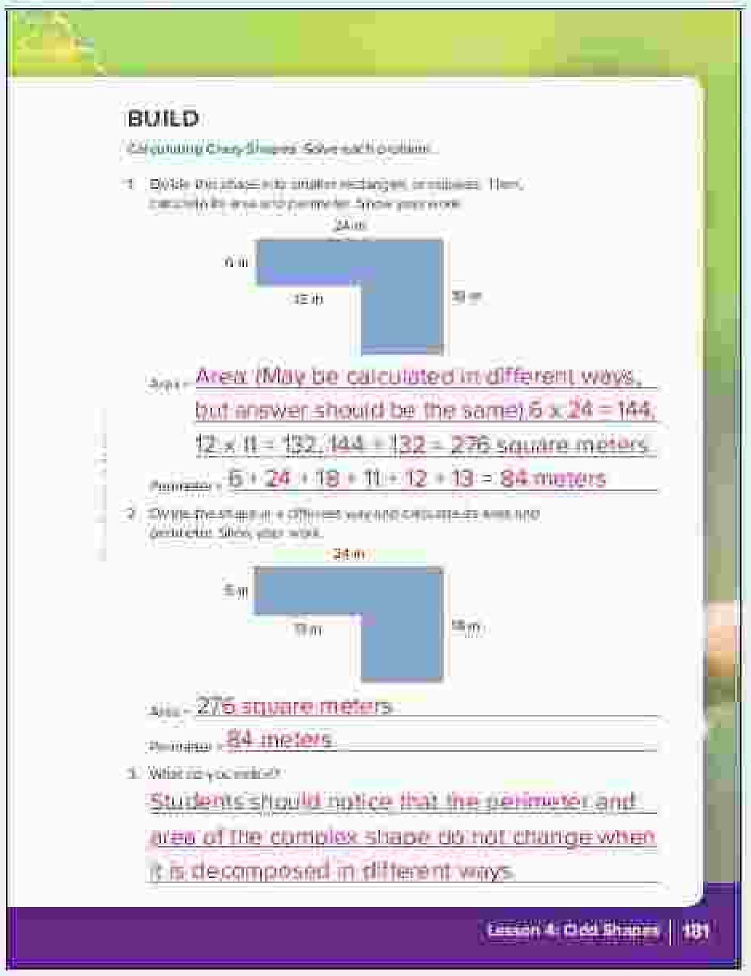
1. Calculate the perimeter and area of the shape your teacher gave you. Record your calculations. Then, at your teacher's direction, cut out your shape along its perimeter.
   Shape: Answers will vary.
   Perimeter: Answers will vary.
   Area: Answers will vary.
2. Work with your partner to create a new shape. Make sure that two sides touch. Trace the new shape.
   New Shape:
   Answers will vary.
3. Talk with your partner about how you would find the new shape's area and perimeter. Record your thinking. (Do not find it yet. Just come up with a strategy.)
   Answers will vary.

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BUILD

Calculating Crazy Shapes: Solve each problem.

1. Divide the shape into smaller rectangles or squares. Then, calculate its area and perimeter. Show your work.

Area = Area (May be calculated in different ways, but answer should be the same) 6 × 24 = 144, 12 × 11 = 132, 144 + 132 = 276 square meters

Perimeter = 6 + 24 + 18 + 11 + 12 + 13 = 84 meters

2. Divide the shape in a different way and calculate its area and perimeter. Show your work.

Area = 276 square meters

Perimeter = 84 meters

3. What do you notice?

Students should notice that the perimeter and area of the complex shape do not change when it is decomposed in different ways.

Lesson 4: Odd Shapes | 181

Answer Key for Making Crazy Shapes:

Shape 1: Perimeter = 20 centimeters; Area = 16 square centimeters

Shape 2: Perimeter = 24 centimeters; Area = 35 square centimeters

Shape 3: Perimeter = 14 centimeters; Area = 10 square centimeters

Shape 4: Perimeter = 14 centimeters; Area = 10 square centimeters

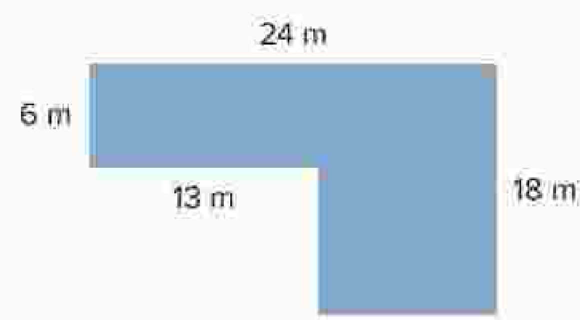
Shape 5: Perimeter = 24 centimeters; Area = 35 square centimeters

Shape 6: Perimeter = 26 centimeters; Area = 12 square centimeters

BUILD (40 min)

Calculating Crazy Shapes

1. Draw the shape on the board and record its measurements.



2. Ask students to talk to a partner about ways this shape could have been made from two other shapes.

3. Ask volunteers to share their ideas. Draw rectangles on the board to help them illustrate their thinking. Students should note that there are several ways to divide this complex shape into squares and rectangles. For example:

   - One long rectangle on top that measures 6 meters × 24 meters and a smaller rectangle on the bottom that measures 12 meters × 11 meters.
   - One short rectangle on the left side that measures 6 × 13 meters and a taller rectangle on the right that measures 11 × 18 meters.
   - One large rectangle that is 24 meters × 18 meters with a smaller rectangle that measures 13 meters × 12 meters missing.

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TEACHER NOTE: Some students may struggle to identify the missing side measurements in the complex shape or in the smaller rectangles and squares. If needed, ask other students to explain to each other how they calculated the missing side measurements. Label each side in the original drawing and in the decomposed drawings, as needed.

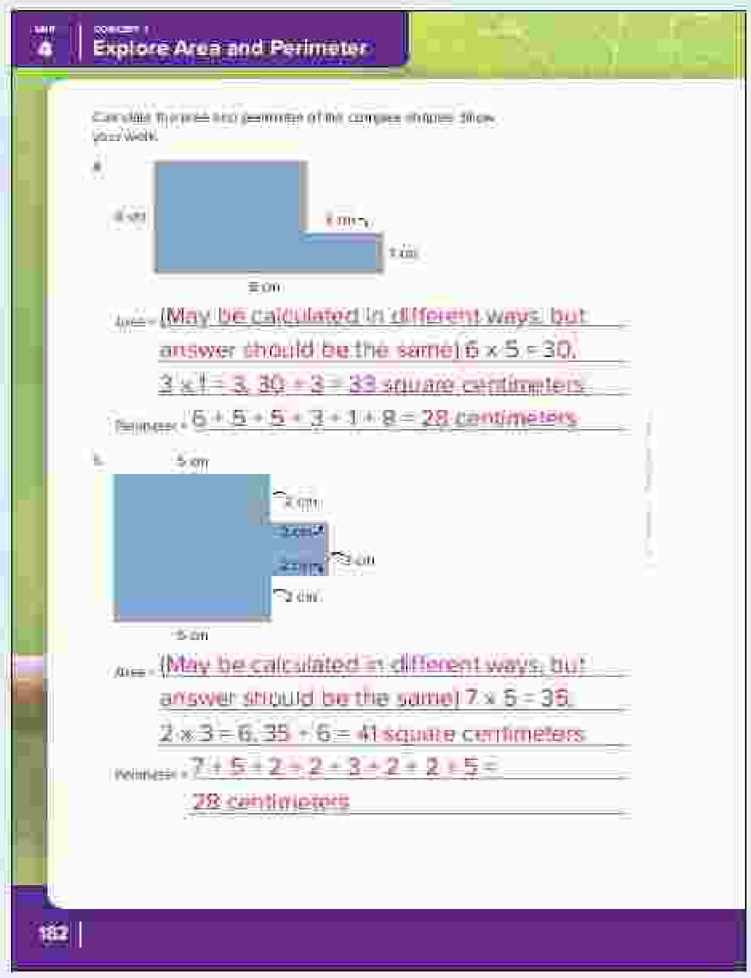
4. Direct students to Lesson 4 BUILD Calculating Crazy Shapes. Ask students to work with their partners to complete Problem 1. Remind students to think of the strategies they came up with during ACCESS and that they can decompose the complex shape into two rectangular shapes.
5. After a few minutes, go over the answer to Problem 1. Then, ask students to work with their partner to complete Problems 2–7. Students who finish early should try the Challenge problem.
6. When there are a few minutes left in BUILD, use an Attention-Getting Signal to regroup the class. Ask students to share their solutions and how they overcame challenges. Ask students who solved the Challenge problem to share their answers.

Answer Key for Complex Shape Calculations:

1. Area: (May be calculated in different ways, but answer should be the same) 6 × 24 = 144, 12 × 11 = 132, 144 + 132 = 276 square meters
   Perimeter: 6 + 24 + 18 + 11 + 12 + 13 = 84 meters
2. Students should decompose the complex shape differently than they did in Problem 1.
   Area: 276 square meters
   Perimeter = 84 meters
3. What do you notice?
   Students should notice that the perimeter and area of the complex shape do not change when it is decomposed in different ways.

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4 | Explore Area and Perimeter

a.

Area = (May be calculated in different ways, but answer should be the same) 6 × 5 = 30, 3 × 1 = 3, 30 + 3 = 33 square centimeters

Perimeter = 6 + 5 + 5 + 3 + 1 + 8 = 28 centimeters

b.

Area = (May be calculated in different ways, but answer should be the same) 7 × 5 = 35, 2 × 3 = 6, 35 + 6 = 41 square centimeters

Perimeter = 7 + 5 + 2 + 2 + 3 + 2 + 2 + 5 = 28 centimeters

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6.



Area = (May be calculated in different ways, but answer should be the same) 1 x 6 = 6, 4 x 10 = 40, 6 + 40 = 46 square meters

Perimeter = 4 + 3 + 1 + 6 + 1 + 1 + 4 + 10 = 30 meters

7. Calculate the area and perimeter of the complex shape you created in ACCESS.

Area = Answers will vary.

Perimeter = Answers will vary.

Challenge: Design your own complex shape and calculate its area and perimeter.

Answers will vary.

Lesson 4: Odd Shapes | 183

4. Area: (May be calculated in different ways, but answer should be the same) 6 × 5 = 30, 3 x 1 = 3, 30 + 3 = 33 square meters
   Perimeter: 6 + 5 + 5 + 3 + 1 + 8 = 28 meters
5. Area: (May be calculated in different ways, but answer should be the same) 7 × 5 = 35, 2 × 3 = 6, 35 + 6 = 41 square centimeters
   Perimeter: 7 + 5 + 2 + 2 + 3 + 2 + 2 + 5 = 28 centimeters
6. Area: (May be calculated in different ways, but answer should be the same) 1 × 6 = 6, 4 × 10 = 40, 6 + 40 = 46 square meters
   Perimeter: 4 + 3 + 1 + 6 + 1 + 1 + 4 + 10 = 30 meters
7. Answers will vary.
8. **Challenge:** Answers will vary.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 4 CONNECT Writing About Math. Ask students to talk with their Shoulder Partner about the question, and then begin writing independently.

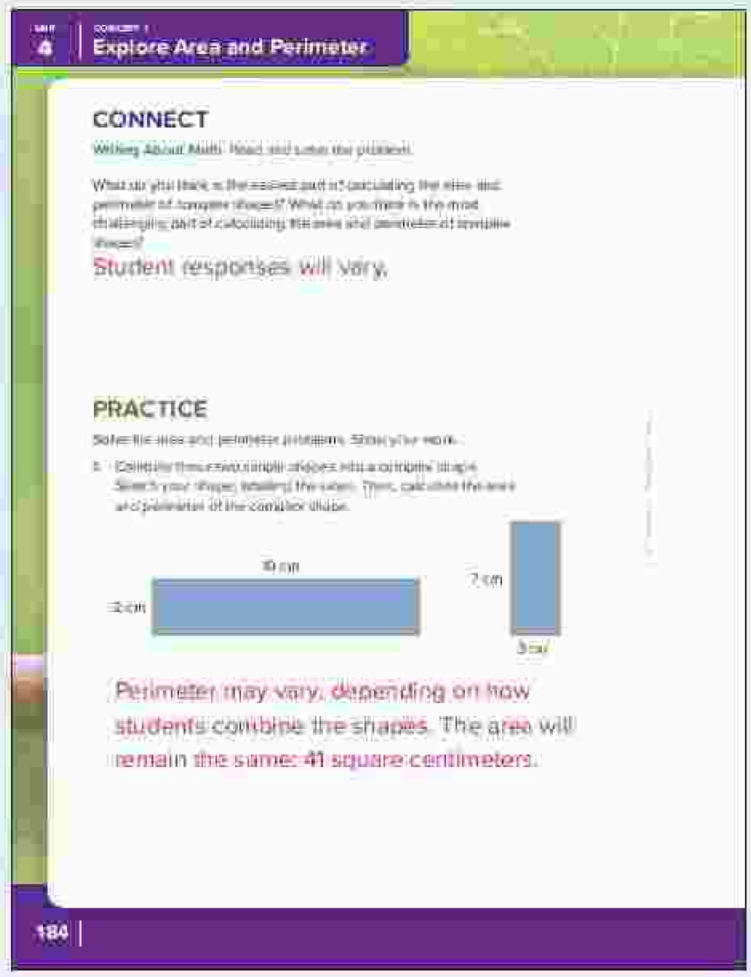
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students when they (or an adult in their family) might need to find the area or perimeter of a complex shape outside of school. Encourage students to ask each other questions.

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UNIT 4 | CONCEPT 1
Explore Area and Perimeter

CONNECT

Writing About Math Read and solve the problem.

What do you think is the easiest part of calculating the area and perimeter of complex shapes? What do you think is the most challenging part of calculating the area and perimeter of complex shapes?

Student responses will vary.

PRACTICE

Solve the area and perimeter problems. Show your work.

1. Combine these two simple shapes into a complex shape. Sketch your shape, labeling the sides. Then, calculate the area and perimeter of the complex shape.

10 cm
2 cm
7 cm
3 cm

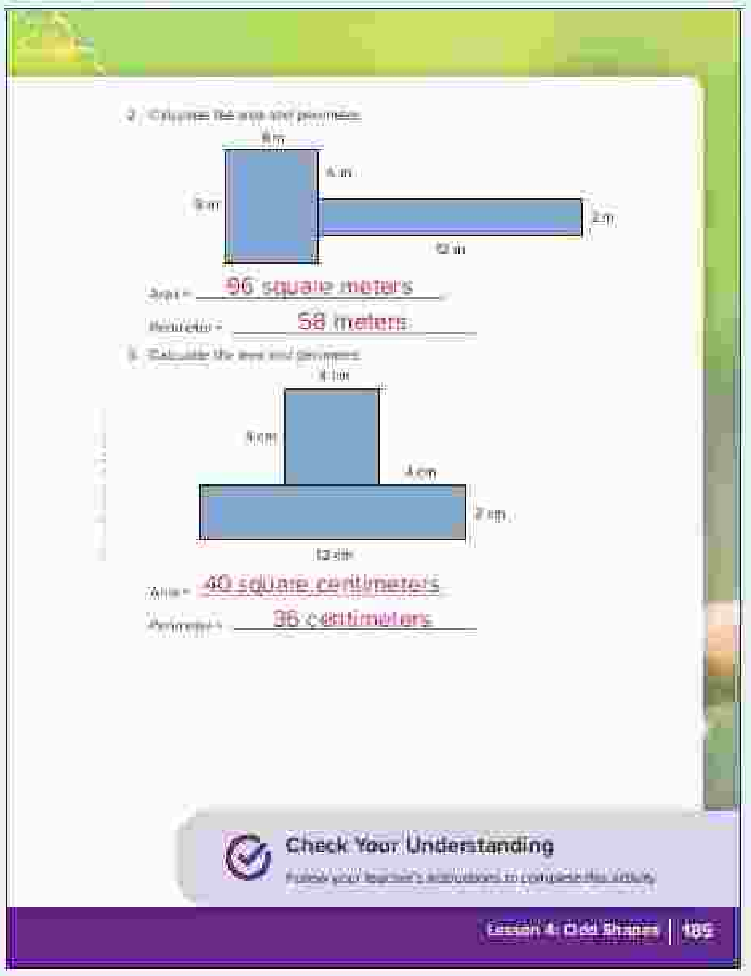
Perimeter may vary, depending on how students combine the shapes. The area will remain the same: 41 square centimeters.

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2. Calculate the area and perimeter.

Area = 96 square meters

Perimeter = 58 meters

3. Calculate the area and perimeter.

Area = 40 square centimeters

Perimeter = 36 centimeters

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 4: Odd Shapes | 185

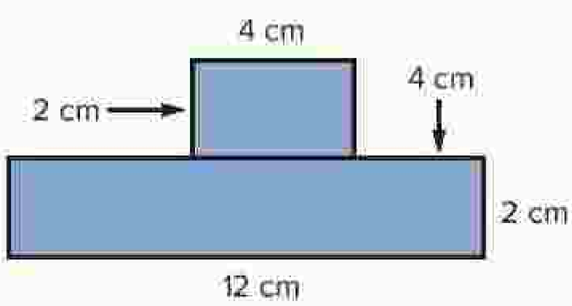
PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve the area and perimeter problems. Show your work.

When Reem calculated the perimeter and area of this shape, she found that the perimeter was 36 centimeters and the area was 32 square centimeters. Only one of those measurements is accurate.



1. Which of Reem's measurement is accurate? Show how you know.
   Area is accurate because (4 × 2) + (12 × 2) = 32 square centimeters.
2. What is the correct answer for Reem's incorrect measurement? Show how you know.
   The perimeter should be 32 centimeters because 2 + 4 + 2 + 4 + 2 + 12 + 2 + 4 = 32 centimeters.
3. Why do you think Reem made that error?
   Students may indicate that she added an extra 4 cm from the bottom of the top rectangle even though that is joined to the larger rectangle. Reem also may have incorrectly calculated the length of unknown sides.

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LESSON 5
Growing Dimensions

Lesson Overview

In this lesson, students apply area and perimeter formulas to solve multistep multiplicative comparison story problems. A multiplicative comparison is a statement demonstrating the relationship between two numbers. Students consistently use phrases such as, "n times as long as…" to make these comparisons. Students use a variety of strategies to solve these problems.

Lesson Essential Question

- How can I efficiently solve area and perimeter problems?

Learning Objective

In this lesson

- Students will use area and perimeter formulas to solve multiplicative comparison problems.

Grade-Level Standards

4.D.1 Solve problems involving measurement and conversion of measurements.

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

array, multiplicative comparison, square units

Materials List

- Cut six 10 cm × 10 cm squares out of colored construction paper (1 set for the teacher)
- Tape

DIGITAL



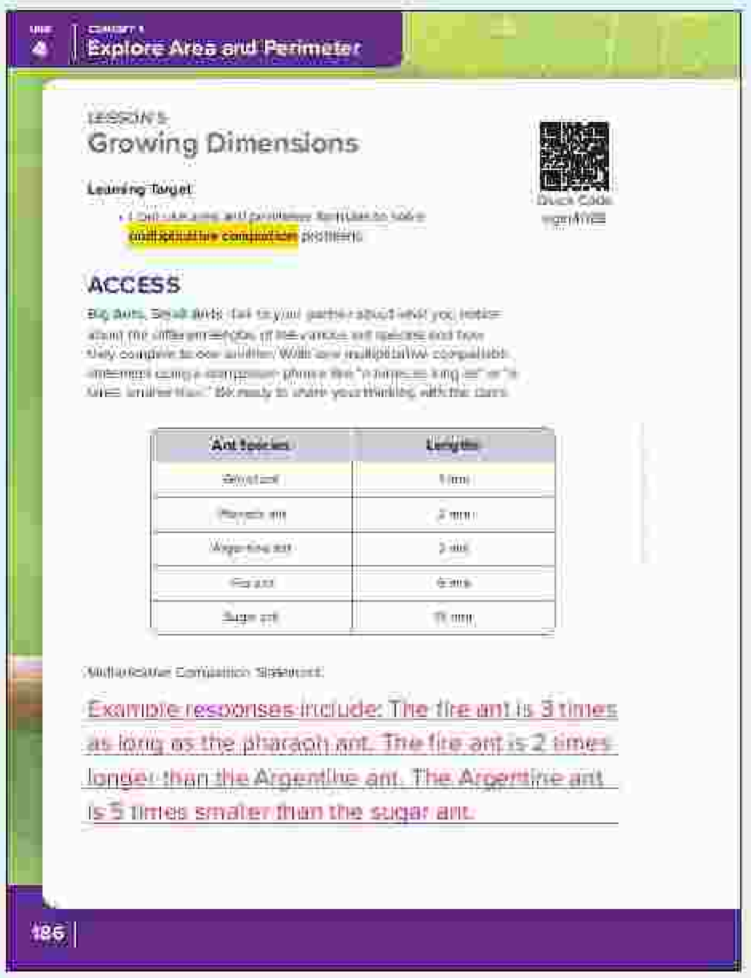
Lesson 5
Growing Dimensions

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Unit 4 | Concept 1 Explore Area and Perimeter

Lesson 5

Growing Dimensions

Learning Target

ACCESS

Ant Species	Lengths
Ghost ant	1 mm
Pharaoh ant	2 mm
Argentine ant	3 mm
Fire ant	6 mm
Sugar ant	15 mm

Multiplicative Comparison Statement:

Example responses include: The fire ant is 3 times as long as the pharaoh ant. The fire ant is 2 times longer than the Argentine ant. The Argentine ant is 5 times smaller than the sugar ant.

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not realize that multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other.
- Students may think that all shapes with a given perimeter have the same area or that all shapes with a given area have the same perimeter.

Big Ants, Small Ants

1. Direct students to Lesson 5 ACCESS Big Ants, Small Ants. Inform students that today they will focus on comparing measurements using the phrase "*n* times as long as . . . ," where *n* represents a number. For example, the pharaoh ant is two times as long as the ghost ant.
2. Ask students to share their observations with a partner and write one multiplicative comparison statement using a comparison phrase like "*n* times as long as" or "*n* times smaller than."
3. After a few minutes, use Calling Sticks to choose two or three students to share their responses.

Answer Key for Big Ants, Small Ants:
Example responses include:

- The fire ant is 3 times as long as the pharaoh ant.
- The fire ant is 2 times longer than the Argentine ant.
- The Argentine ant is 5 times smaller than the sugar ant.

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BUILD (40 min)

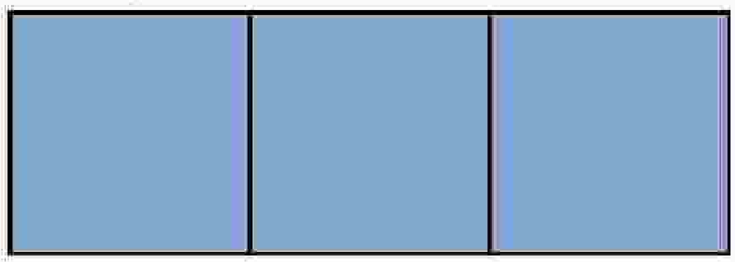
Draw and Solve (20 min)

1. Explain to students that today they will use multiplicative comparisons using the phrase "*n* times as long as" where *n* represents a number to solve area and perimeter problems.

2. Direct students to the beginning of Lesson 5 to silently read the Learning Target.

3. Model using square tiles to compare sizes. Call on some students to help you:

   - Let's create a rectangle that has a width of 1 unit and a length 3 times as long. (Tape three squares on the board, side by side.)



ASK

- *What is the width and length of this rectangle?* (width = 1 unit; length = 3 units)
- *What is the area of this rectangle?* (3 square units)
- *What is the perimeter of this rectangle* (8 units)

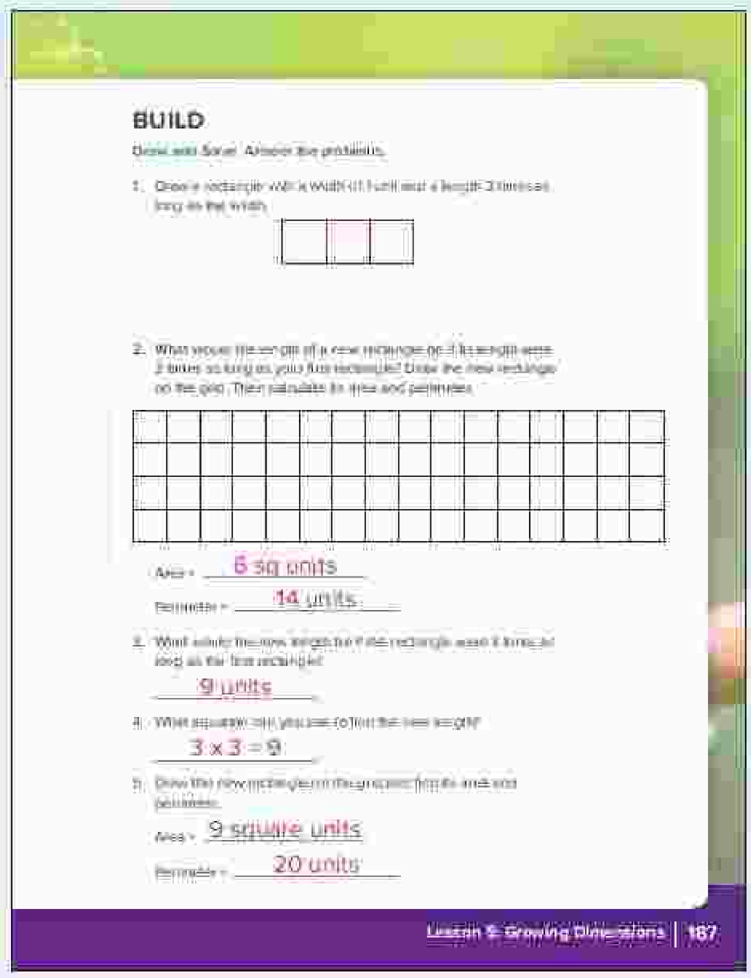
Record responses on the board as students answer.

4. Ask students to turn to Lesson 5 BUILD Draw and Solve and draw the rectangle on the grid paper.

5. Tell students you want to create a new rectangle with a length 2 times as long as the original rectangle. Ask students how many squares you should add. (3) Add 3 squares to your rectangle on the board and ask students to draw the new rectangle in their Student Edition and to find the area and perimeter. Ask students questions and give them time to discuss.

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BUILD

Area = 6 sq units

Perimeter = 14 units

9 units

3 x 3 = 9

Area = 9 square units

Perimeter = 20 units

Lesson 5: Growing Dimensions | 187

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Unit 4 | Explore Area and Perimeter

Area = 100 square centimeters

Perimeter = 50 centimeters

Picnic Blanket

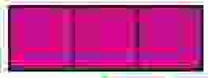
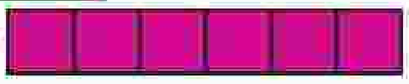
ASK

- *What is the width and length of this new rectangle?*
  (width = 1 unit; length = 6 units)
- *What is the area of this rectangle?*
  (6 square units)
- *What is the perimeter of this rectangle*
  (14 units)
- *Is there a relationship between the measurements of the first rectangle and the new rectangle?*
  (The area of the second rectangle is two times as large as the first rectangle.)

Record responses on the board as students answer.

6. Ask students to complete Problems 3–6 in their Student Edition.
7. Use Calling Sticks to call on two or three students to share their responses.

Answer Key for Draw and Solve:

1. 
2. 6 units 

Area = 6 square units

Perimeter = 14 units

3. 9 units
4. $3 \times 3 = 9$
5. 

Area = 9 square units

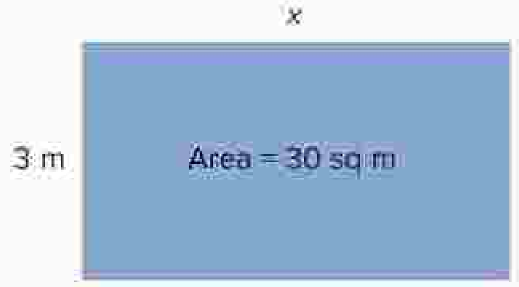
Perimeter = 20 units

6. Students should draw a rectangle labeled 5 centimeters wide and 20 centimeters long.
   Area = 100 square centimeters
   Perimeter = 50 centimeters

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Picnic at the Park (20 min)

1. Draw the following on the board and ask students how they can find the missing side.

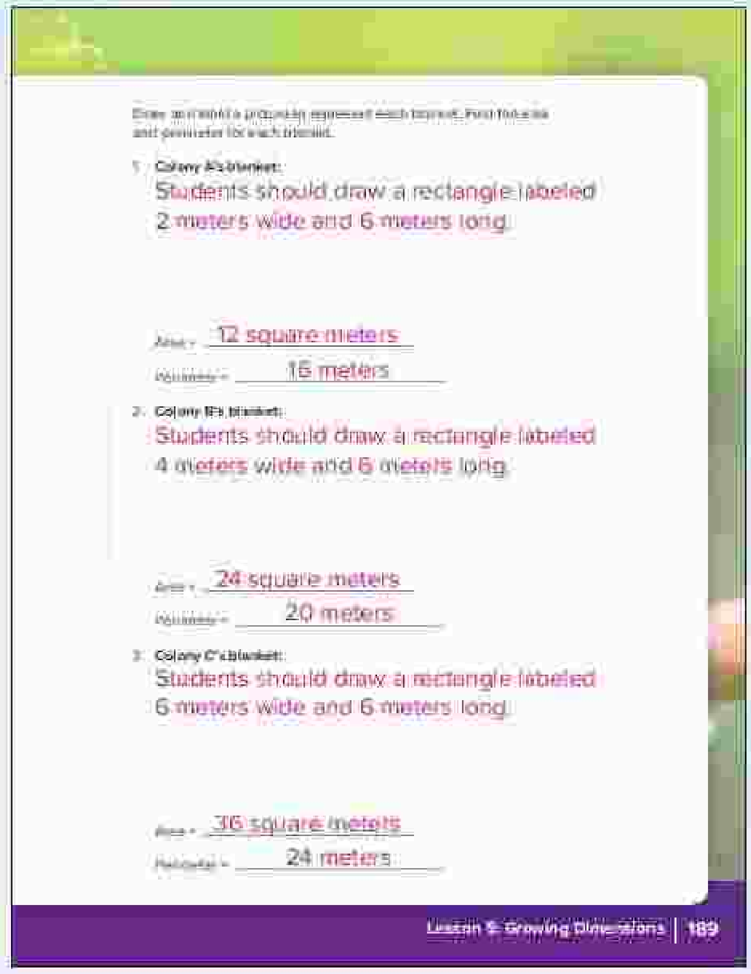


2. Tell students the rectangle represents a playground. The border of the rectangle is the fence around the playground. Tell students the school wants to put in a jungle gym that has the same width as the playground, but is $\frac{1}{2}$ as long as the playground. Ask:
   - What is the length of the jungle gym? 5 meters
   - What is the area of the jungle gym? 15 square meters
   - How much room will be left on the playground? 15 square meters
3. Ask students to share their thinking with their Shoulder Partner. Then, ask volunteers to share their strategies and solutions. Ask questions to prompt students' thinking, such as:
   - What do we need to do to answer these questions? (Find the length of the jungle gym and calculate the area.)
   - What do we do once we know the area of the jungle gym? How do we find out how much room is left? (Subtract the area of the jungle gym from the area of the playground.)

   TEACHER NOTE: This problem is not in the Student Edition. It is meant to be a conversation between student partners and the whole class. The numbers are small enough that hopefully students can use mental computation, but allow students to use paper, if necessary.
4. Explain that there are many strategies students can use to solve this problem.
5. Ask students to turn to Lesson 5 BUILD Picnic at the Park and work with a partner to complete Problems 1–3.

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Student Page 189



1. Colony A's blanket:
Students should draw a rectangle labeled 2 meters wide and 6 meters long.
12 square meters
16 meters

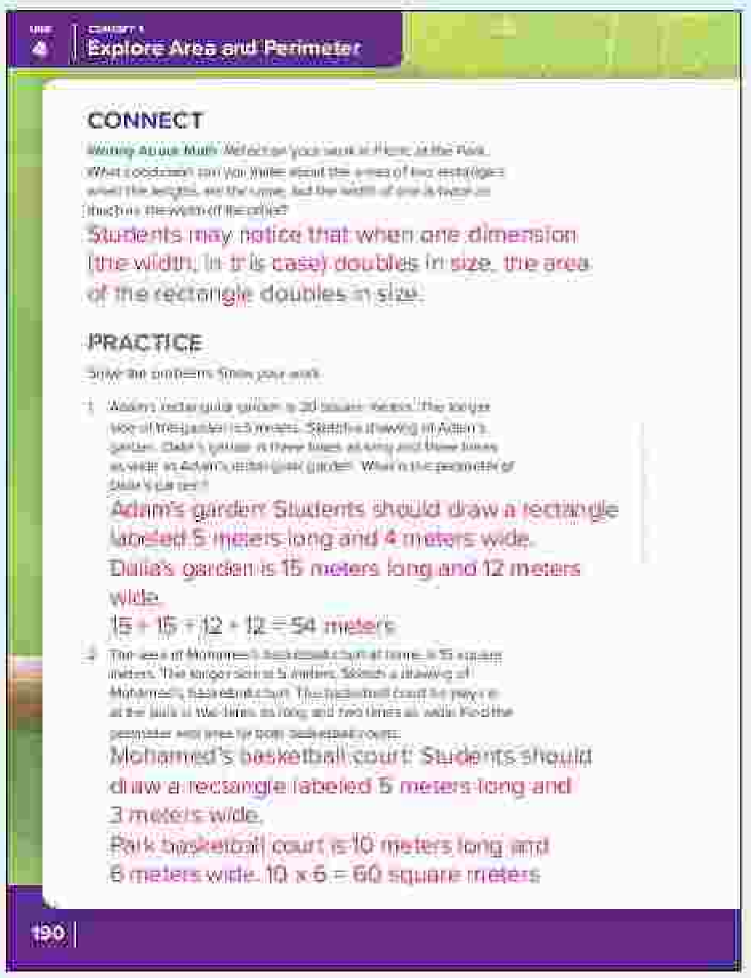
2. Colony B's blanket:
Students should draw a rectangle labeled 4 meters wide and 6 meters long.
24 square meters
20 meters

3. Colony C's blanket:
Students should draw a rectangle labeled 6 meters wide and 6 meters long.
36 square meters
24 meters

Lesson 5: Growing Dimensions | 189

PRINT

Student Page 190


Explore Area and Perimeter

CONNECT

Students may notice that when one dimension (the width, in this case) doubles in size, the area of the rectangle doubles in size.

PRACTICE

Adam's garden: Students should draw a rectangle labeled 5 meters long and 4 meters wide.
Dalia's garden is 15 meters long and 12 meters wide.
15 + 15 + 12 + 12 = 54 meters

Mohamed's basketball court: Students should draw a rectangle labeled 5 meters long and 3 meters wide.
Park basketball court is 10 meters long and 6 meters wide. 10 x 6 = 60 square meters

190

6. At the end of BUILD, use an Attention-Getting Signal to bring the group back together. Discuss the ways students tried to solve the problems, the diagrams they created for each problem, and the relationships between the perimeters in the problem. Questions to ask may include:

ASK

- *How did you use your knowledge of area and perimeter to solve the problems?*
- *What conclusion can you make about the areas of the rectangles?*

Answer Key for Picnic at the Park:
Length of original rectangle: 10 meters
Length of jungle gym: 5 meters
Area of jungle gym: 15 square meters
Area of original playground minus area of jungle gym:
30 square meters – 15 square meters = 15 square meters

1. Colony A: Students should draw a rectangle labeled 2 meters wide and 6 meters long. Area = 12 square meters. Perimeter = 16 meters

2. Colony B: Students should draw a rectangle labeled 4 meters wide and 6 meters long. Area = 24 square meters. Perimeter = 20 meters

3. Colony C: Students should draw a rectangle labeled 6 meters wide and 6 meters long. Area = 36 square meters. Perimeter = 24 meters

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 5 CONNECT Writing About Math and respond to the prompt.

Answer Key for Writing About Math:
Students may notice that, when one dimension (the width, in this case) doubles in size, the area of the rectangle doubles in size.

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WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to talk to their Shoulder Partner about their Writing About Math response.
2. Use Calling Sticks to have two or three students share their ideas with the class.

PRACTICE

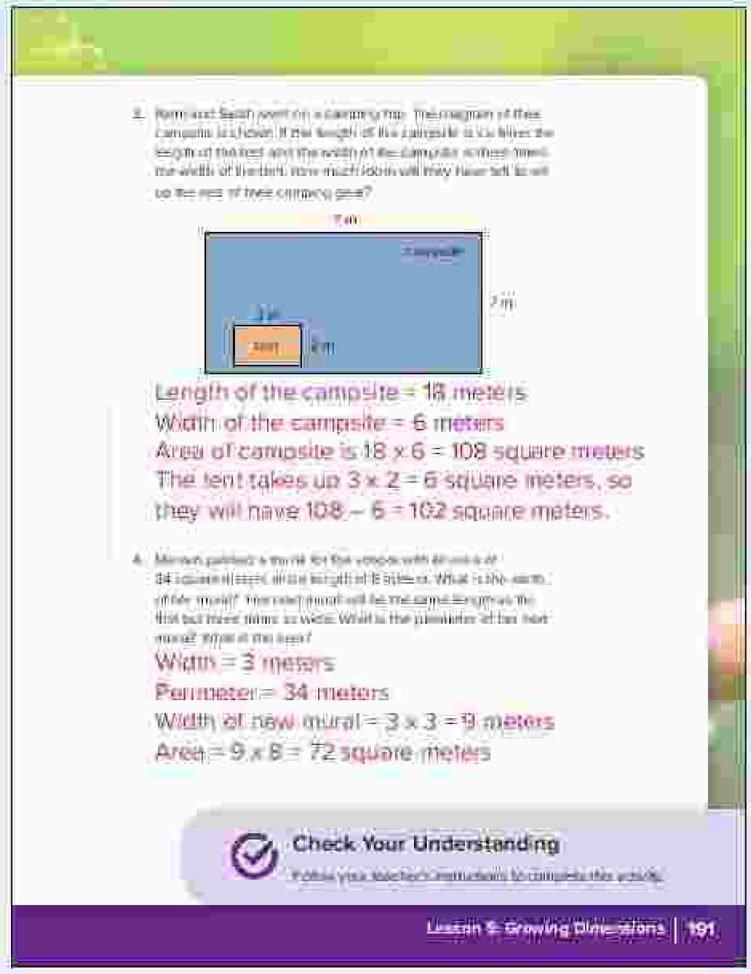
Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Work your way through the maze. Begin at Start.

PRINT

Student Page 191


Length of the campsite = 18 meters
Width of the campsite = 6 meters
Area of campsite is 18 × 6 = 108 square meters
The tent takes up 3 × 2 = 6 square meters, so they will have 108 – 6 = 102 square meters.

Width = 3 meters
Perimeter = 34 meters
Width of new mural = 3 × 3 = 9 meters
Area = 9 × 8 = 72 square meters

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 5: Growing Dimensions | 191

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START

What would the length be if a rectangle is 3 units wide and 4 times as long?

12

A rectangular pool is 3 meters wide. It is 3 times as long as it is wide. What is its area?

9

What would the area be if a rectangle is 3 units wide and 2 times as long?

7 | 4 | 27 | 10 | 18

A rectangular terrace is 300 cm wide. It is twice as long as it is wide. What is its length?

24

A poster is 6 centimeters wide. It is 4 times as long as it is wide. What is its perimeter?

60

Ahmad painted a mural with a length of 6 meters and a width of 3 meters. His next mural will be the same length as the first but 4 times as wide. What is the perimeter of his next mural?

600 | 30 | 144 | 20 | 36

The area of a rectangle is 42 square centimeters. Its length is 7 centimeters. A second rectangle is drawn that is the same length but is 3 times as wide. What is the second rectangles area?

12

A rectangular field is 4 meters wide. It is 3 times as long as it is wide. What is its perimeter?

40

Using the drawing below, what will the area be if the new rectangle is twice the length?

4

5

126 | 80 | 32 | 20 | 28

What would the perimeter be if a rectangle is 20 units wide and 4 times as long?

120

END!

30

What would the perimeter be if a rectangle is 10 cm long and the width is ½ as long as the length?

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Explore Area and Perimeter. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed in the chart, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How are area and perimeter related?
- How can I efficiently solve area and perimeter problems?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to area and perimeter.

Grade-Level Standards

4.D.1.d Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Vocabulary Check-In

Review concept vocabulary as needed

Materials List

Materials will vary

DIGITAL



Concept Check-In and Remediation

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COMMON MISCONCEPTIONS AND ERRORS

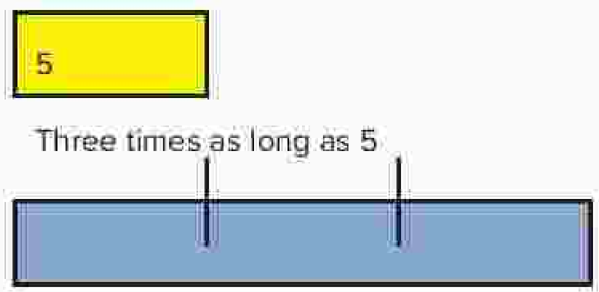
- Students may confuse area and perimeter.
- Students may overgeneralize or under generalize the definition of area and/or perimeter situations.
- Students may not realize that multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other.
- Students may think that all shapes with a given perimeter have the same area or that all shapes with a given area have the same perimeter.

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Remediation: Correcting Misconceptions

If . . .	Then . . .
Students confuse perimeter or area.	Review Lessons 1 and 2. Consider having students build smaller rectangles with square cubes or draw rectangles on graph paper, counting the number of square units and also counting the perimeter units. Clarify names of units, ensuring that students understand that perimeter is a measurement of unit lengths and area is a measurement of square units. Provide hands-on practice building and drawing to solve perimeter and area problems. This can help students build concrete understanding that can later be transferred to abstract formulas.
If . . .	**Then . . .**
Students over or under generalize area and perimeter in story problems.	Work with small groups to review story problems from throughout the unit. Provide a variety of examples of story problems and ask students to sort them into perimeter or area problems. Support students as they solve the problems.

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If . . .	Then . . .
Students do not realize that multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other.	Review Lesson 4. Consider engaging students in more practice where they are given one number and determine 2 times as much or 3 times as much. Students can use graph paper or bar models to draw the initial amount and the new amount to concretely see the multiplicative comparison. Examples: 
If . . .	**Then . . .**
Students think that all shapes with a given perimeter have the same area or that all shapes with a given area have the same perimeter.	Review the CONNECT sections of Lessons 1 and 2. Consider having students build or draw a variety of rectangles with the same areas and see how that affects the perimeters and vice versa.



UNIT

5

MULTIPLICATION AS A RELATIONSHIP

Theme 2 | Mathematical Operations and Algebraic Thinking

Unit 5 Multiplication as a Relationship

ESSENTIAL QUESTIONS

- How can multiplication be used to compare numbers?
- How can understanding properties and patterns in multiplication help us to solve problems more efficiently?
- How does understanding place value help me to solve multiplication problems?

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Video Questions

The Unit 5 Opener Video, Multiplication Moments, encourages the use of multiplication to calculate the number of people who travel by different modes of transportation. Omar and Mariam are investigating and comparing numbers of people who travel on different types of transportation.

- How can they use multiplication instead of addition to calculate large quantities?

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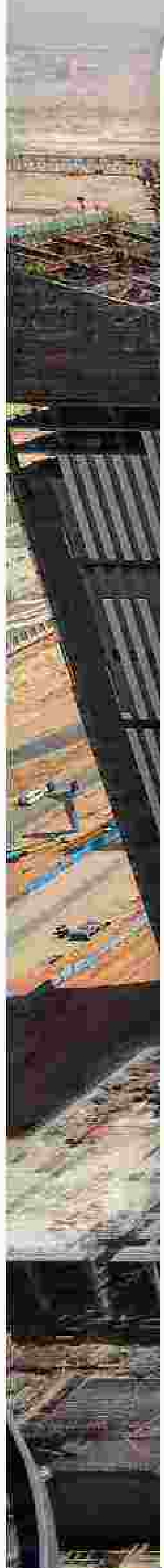
Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

array, Associative Property of Multiplication, column, Commutative Property of Multiplication, decompose, equation, estimate, factor, Identity Property of Multiplication, inverse, multiples, multiplicative comparison, parentheses, product, tape diagram, Zero Property of Multiplication

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Unit Storyline

Unit 5 Multiplication as a Relationship Storyline

The Multiplication as a Relationship unit extends students' working knowledge of comparing quantities using addition and subtraction (additive comparison). Students apply these understandings to comparing quantities using multiplication (multiplicative comparison). Strategies introduced in this unit will be used in future grades related to proportional relationships. To support learning, students observe video footage and investigate problems related to different modes of transportation to enhance their understanding of comparing quantities using multiplication.

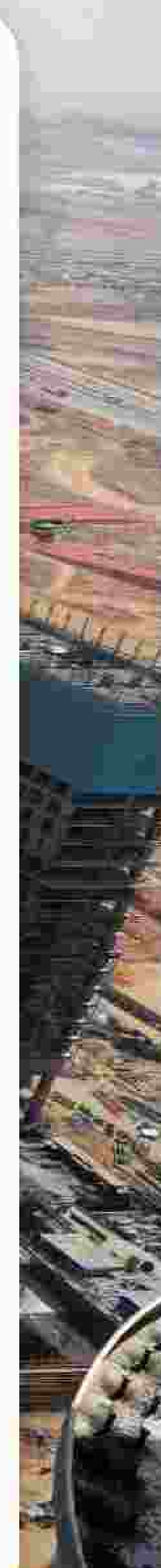
Unit Standards

4.A.2.b	Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.
4.C.1.a	Interpret a multiplication equation as a comparison.
4.C.1.b	Represent verbal statements of multiplicative comparisons as multiplication equations.
4.C.1.c	Multiply or divide to solve word problems involving multiplicative comparison. (for example, using drawings and equations with a symbol for the unknown number to represent the problem).

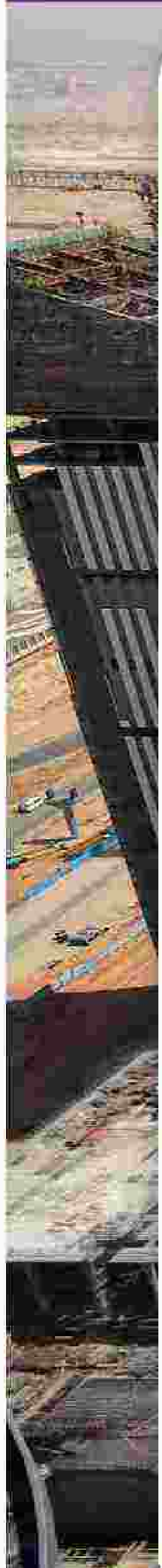
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Unit 5 Structure and Pacing

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.	
Concept 1: Multiplicative Comparisons	
Lesson 1	**Understanding Multiplicative Comparison** **Learning Objectives** • Students will define multiplicative comparison. • Students will model multiplicative comparison problems. **Student Learning Targets** • I can define multiplicative comparison. • I can explain how multiplication can be used to compare numbers. • I can create models to show multiplicative comparisons.
Lesson 2	**Creating Multiplicative Comparison Equations** **Learning Objectives** • Students will create equations to represent multiplicative comparison problems. • Students will use letters to represent unknown quantities in equations. **Student Learning Targets** • I can create multiplication equations to represent comparisons. • I can use a letter to represent a missing number in a multiplication problem.
Lesson 3	**Solving Multiplicative Comparison Equations** **Learning Objective** • Students will create and solve multiplicative comparison equations. **Student Learning Target** • I can solve a multiplication equation that represents a comparison.



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Unit Structure and Pacing *cont'd*

Concept Check-In and Remediation

Learning Objective

- Students will work to correct misconceptions and errors related to multiplicative comparisons.

Student Learning Target

- I can correct my misconceptions and errors related to multiplicative comparisons.

Concept 2: Properties and Patterns of Multiplication

Lesson 4

Commutative Property of Multiplication

Learning Objectives

- Students explain the Commutative Property of Multiplication.
- Students will apply the Commutative Property of Multiplication to solve problems.

Student Learning Targets

- I can explain the Commutative Property of Multiplication.
- I can apply the Commutative Property of Multiplication to solve problems with and without an unknown number.

Lesson 5

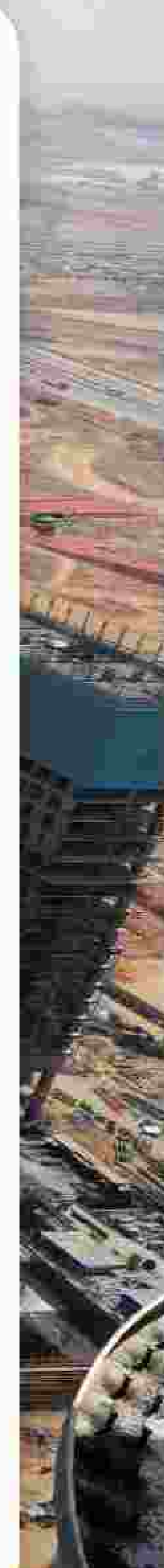
Patterns of Multiplying by 10s

Learning Objectives

- Students will apply the Identity Property of Multiplication to solve problems.
- Students will apply the Zero Property of Multiplication to solve problems.
- Students will identify patterns that occur when multiplying by 10, 100, and 1,000.

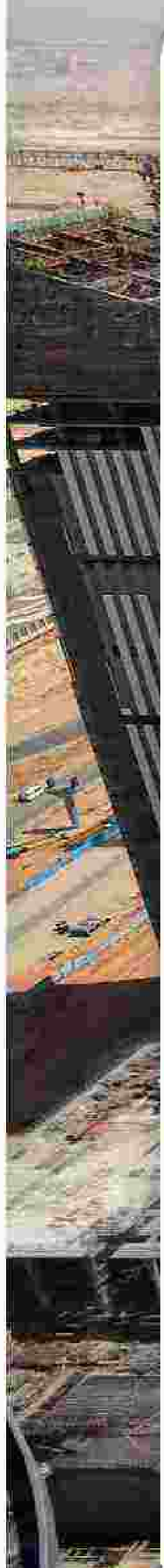
Student Learning Targets

- I can explain the Identity Property and Zero Property of Multiplication.
- I can apply the Identity and Zero Properties of Multiplication to solve problems.
- I can identify patterns I observe when multiplying by 10, 100, and 1,000.



Lesson 6	**Review Exploring Patterns in Multiplication** **Learning Objectives** • Students will apply place value concepts to multiply by multiples of 10, 100, and 1,000. • Students will explain patterns when multiplying by multiples of 10, 100, and 1,000. **Student Learning Targets** • I can use place value to multiply by multiples of 10, 100, and 1,000. • I can explain patterns when multiplying by multiples of 10, 100, and 1,000.
Lesson 7	**Exploring More Patterns in Multiplication** **Learning Objectives** • Students will explain the Associative Property of Multiplication. • Students will apply the Associative Property of Multiplication to solve problems. **Student Learning Targets** • I can explain the Associative Property of Multiplication. • I can apply the Associative Property of Multiplication to solve problems.
Lesson 8	**Applying Patterns in Multiplication** **Learning Objective** • Students will apply decomposing and the Associative Property of Multiplication to solve equations with multiples of 10, 100, or 1,000. **Student Learning Target** • I can apply decomposing and the Associative Property of Multiplication to solve equations with multiples of 10, 100, or 1,000.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to properties and patterns of multiplication. **Student Learning Target** • I can correct my misconceptions and errors related to properties and patterns of multiplication.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:
Reduce ACCESS by 3 minutes
Reduce BUILD by 8 minutes
Reduce CONNECT by 2 minutes
Reduce WRAP-UP by 2 minutes
Strategies for reducing time in each section: • Discuss fewer examples • Eliminate Shoulder Partner conversations • Shorten class discussions • Work with students to complete ACCESS problems
If Mathematics instruction is based on a combination of 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:
Follow the 45-minute approach for the 45-minute days.
Teach two 45-minute lessons on the 90-minute day.
If Mathematics instruction is based on 90 minutes/5 days a week, do the following:
Increase ACCESS by 5 minutes
Increase BUILD by 20 minutes
Increase CONNECT by 3 minutes
Increase WRAP-UP by 2 minutes
Strategies for increasing time in each section: • Discuss additional examples as needed • Extend class discussions • Allow time for hands-on work with manipulatives and models • Provide additional practice problems for students who need additional practice • Encourage students to share and model their problem-solving strategies

Mathematical Background Knowledge

Multiplicative Comparison

In Primary 3, students developed their understanding of multiplication and division using equal groups. In Primary 4, students build on that knowledge by exploring how multiplication and division can be used to compare quantities. Students are already familiar with comparing quantities using addition and subtraction (additive comparison). Now students learn that multiplication can also be used to compare numbers (multiplicative comparison). Students use tape diagrams to represent these relationships between numbers. This strategy is important in building an understanding of proportional relationships in future grades.

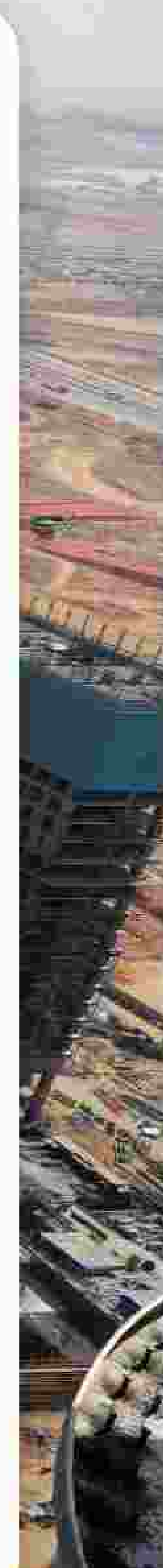
In Primary 3 students modeled and solved multiplication and division problems. In Primary 4, students learn how to write equations using a letter to represent an unknown value. It is important to note that when creating these equations, the unknown number can be in different positions in the equation ($4 \times a = 16$ or $b = 4 \times 4$).

In Primary 3 students used various strategies such as drawings and arrays to solve multiplication and division problems and developed an understanding of the relationship between those operations. Students learned that like addition and subtraction, multiplication and division are inverse operations and that the numbers in a multiplication or division equation form a fact family. In Primary 4, students further these understandings as they solve for an unknown in a multiplication equation. Students may continue to utilize models to solve multiplication equations but should be moving towards mastery of multiplication facts from memory.

Properties of Multiplication

In Primary 3 students were introduced to several properties when building their understanding of multiplication. In Primary 4, students review the rules for multiplying by 0 and 1 and name these rules. The Zero Property of Multiplication states that any factor multiplied by zero equals zero and the Identity Property of Multiplication states that any factor multiplied by 1 equals itself. They utilize their knowledge of place value to explore how one factor changes as it is multiplied by 10, 100, and 1,000. They explain the patterns that they notice and relate them to the place of the digit with the highest value and the number of zeroes in the factor. Students in Primary 4 identify patterns when multiplying by multiples of 10, 100, and 1,000 in order to strengthen their understanding of place value in multiplication and to prepare them for learning strategies for multidigit multiplication.

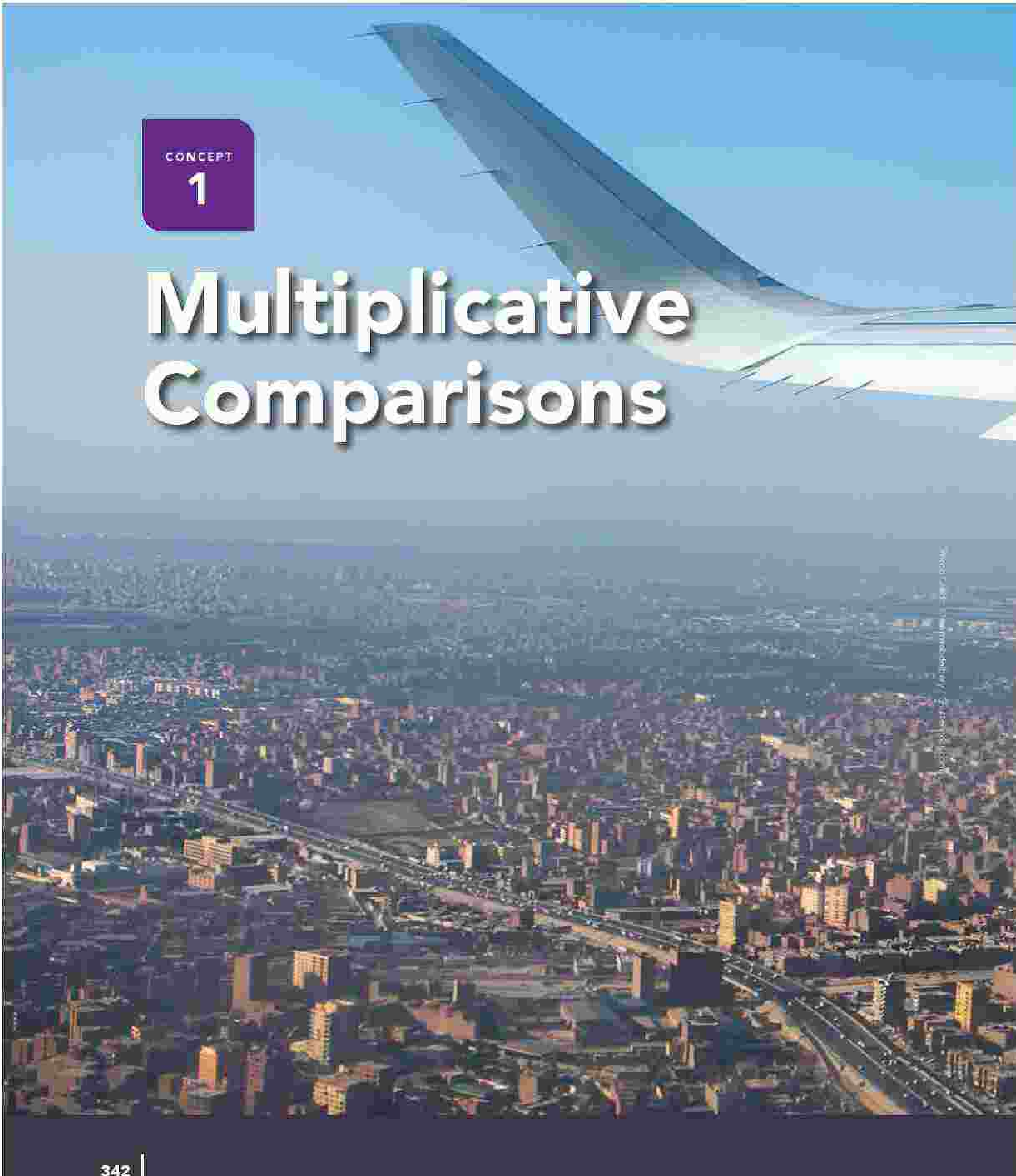
Primary 4 students also review the Commutative and Associative Properties of Multiplication and apply them in new and challenging ways. They are introduced to the use of parentheses in mathematics, an important grouping symbol that will be used again when students learn to evaluate expressions in Primary 5. Students think about strategically pairing factors in order to solve complex multiplication problems more efficiently. Being able to think flexibly about numbers and understanding a variety of strategies will help students to better understand multidigit multiplication.



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CONCEPT 1

Multiplicative Comparisons



Concept Overview

In Concept 1: Multiplicative Comparisons, students continue to compare numbers but move away from place value comparisons into multiplicative relationships. It is important for students to review and recall the multiplication facts they learned in Primary 3, since this makes it easier for them to see multiplicative relationships in familiar numbers. Students also discuss the application of multiplicative comparisons in real-world contexts, connecting their understanding of math to their daily lives.

Concept Standards

4.C.1.a Interpret a multiplication equation as a comparison.

4.C.1.b Represent verbal statements of multiplicative comparisons as multiplication equations.

4.C.1.c Multiply or divide to solve word problems involving multiplicative comparison, (for example, using drawings and equations with a symbol for the unknown number to represent the problem).

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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Understanding Multiplicative Comparison	• Scissors (1 per student) • Glue or glue stick (1 per student) • Tape Photocopy the following Blackline Masters, found at the end of this volume. • Teacher Paper Strip 90 cm (1 for the teacher) • Strips of paper 3 cm long (1 per student) • Student Tapes (1 copy per student)	Estimate Multiplicative comparison Tape diagram	• Students will define multiplicative comparison. • Students will model multiplicative comparison problems.	
2 Creating Multiplicative Comparison Equations	• No additional materials needed	Equation Factor Multiplicative comparison Product	• Students will create equations to represent multiplicative comparison problems. • Students will use letters to represent unknown quantities in equations.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students often confuse multiplicative comparison with additive comparison. For example, instead of multiplying by 4 to find a number 4 times greater than 20, students might add 4. • Students may have difficulty building conceptual understanding of a number being × times greater than another number.	Multiplicative Comparison with Numbers, Writing About Math, Practice, Check Your Understanding
	• Students may always write an equation as known × known = unknown, but an equation can also be written as unknown = known × known. Both equations are correct as long as what is on one side of the equal sign is equal to what is on the other. • Students may incorrectly place the unknown in an equation. For example, if a student is asked to write 12 is 3 times greater than a, they may write 12 × 3 = a, instead of 12 = 3 × a or 3 × a = 12.	Multiplying to Show Comparisons, Creating Equations for Multiplicative Comparison Statements, Exit Ticket, Practice, Check Your Understanding

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
3 Solving Multiplicative Comparison Equations	• No additional materials needed	Inverse	• Students will create and solve multiplicative comparison equations.	
Concept Check-In and Remediation	• Materials will vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to multiplicative comparisons.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may have trouble creating their own comparison statement and equation using the information provided. • Students may not recognize that multiplication and division facts can inform the relationships they are exploring.	How Many Seats?, More Seats to Sail, Practice, Check Your Understanding
	• Students may have difficulty building conceptual understanding of a number being x times greater than another number. • Students may always write an equation as known × known = unknown, but an equation can also be written as unknown = known × known. Both equations are correct as long as what is on one side of the equal sign is equal to what is on the other. • Students may incorrectly place the unknown in an equation. For example, if a student is asked to write 12 is 3 times greater than a, they may write $12 \times 3 = a$, instead of $12 = 3 \times a$. • Students may have trouble creating their own comparison statement and equation using the information provided.	

LESSON 1
Understanding Multiplicative Comparison

Lesson Overview

In this lesson students investigate how multiplication can be used to compare quantities. Students are introduced to tape diagrams as another strategy for visualizing multiplication and relationships between numbers.

Lesson Essential Question

- How can multiplication be used to compare numbers?

Learning Objectives

In this lesson

- Students will define multiplicative comparison.
- Students will model multiplicative comparison problems.

Grade-Level Standards

4.C.1.a Interpret a multiplication equation as a comparison.

4.C.1.b Represent verbal statements of multiplicative comparisons as multiplication equations.

Vocabulary Check-In

estimate, multiplicative comparison, tape diagram

Materials List

- Scissors (1 per student)
- Glue or glue stick (1 per student)
- Tape

Preparation

Photocopy the following Blackline Masters (at the end of this volume).

- Teacher Paper Strip 90 cm long (1 for the teacher)
- Strips of paper 3 cm long (1 per student)
- Student Tapes (1 copy per student)

DIGITAL

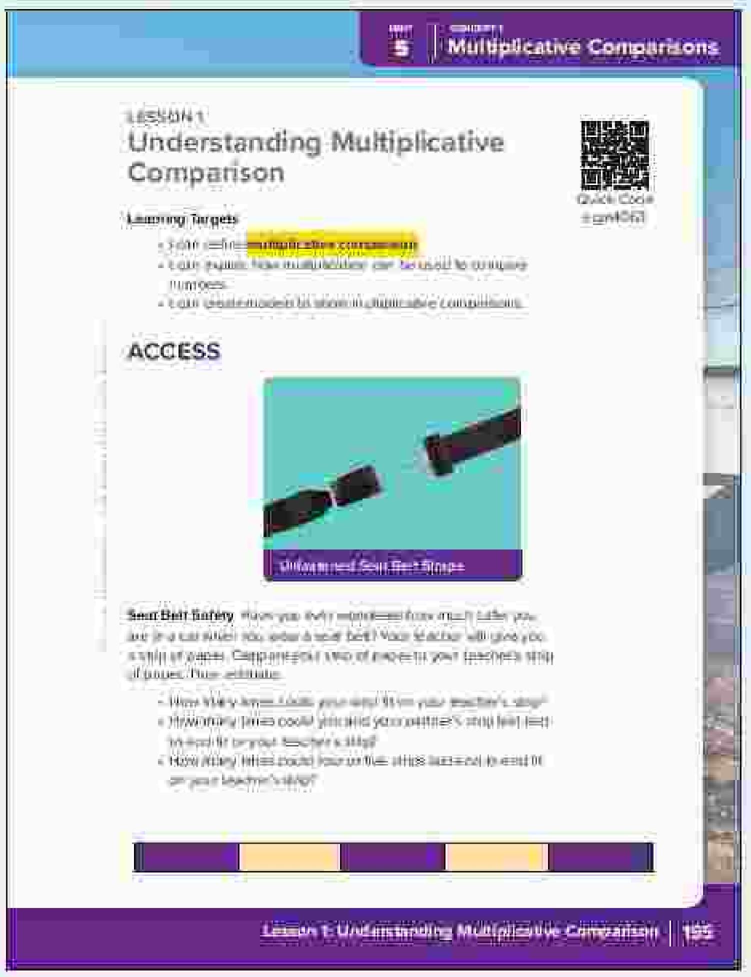


Lesson 1
Understanding Multiplicative Comparison

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PRINT

Student Page 195



ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students often confuse multiplicative comparison with additive comparison. For example, instead of multiplying by 4 to find a number 4 times greater than 20, students might add 4.
- Students may have difficulty building conceptual understanding of a number being *x* times greater than another number.

Seat Belt Safety

1. Tape the 90-cm strip of paper onto the board or wall, where all students can see it. Label it 90 cm. Distribute one 3-cm strip of paper to each student. Ask students to write 3 cm on their strips.
2. Tell students that their strips represent how safe it is to ride in a car without a seatbelt. Show students the 90-cm strip and tell them that it represents how safe it is to ride in a car with a seatbelt.
3. Ask students to turn to Lesson 1 ACCESS Seat Belt Safety. Ask students to mentally compare the strips and think about what they illustrate about safety riding in a car with and without a seatbelt.
4. Ask students to estimate how many of their strips they think it would take to equal the teacher's strip. (If necessary, remind students that estimating does not require an exact answer.)
5. Ask students to work with a partner to put their strips together end-to-end and refine their estimates. If possible, have students work in small groups to put their strips together end-to-end to further refine their estimates.
6. Record estimates on the board and tell students they will come back to this idea at the end of the lesson. (Make sure students keep their 3-cm strips out.)

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BUILD (40 min)

Visualizing Multiplicative Comparison with Diagrams (15 min)

1. Tell students that so far they have used place value to compare numbers, but today they will compare numbers using multiplication. Explain that they have already gotten a little practice doing that by comparing their strip to your strip and estimating "how many times" their small strip could fit onto the larger strip.
2. Tell students they will be using tape diagrams to learn how to compare using multiplication. Explain that a tape diagram is a visual model that helps us understand number relationships.
3. Show students how to create a tape diagram. Draw two rectangles on the board, each representing 5. Tell students that this diagram shows 5 two times.

5	5

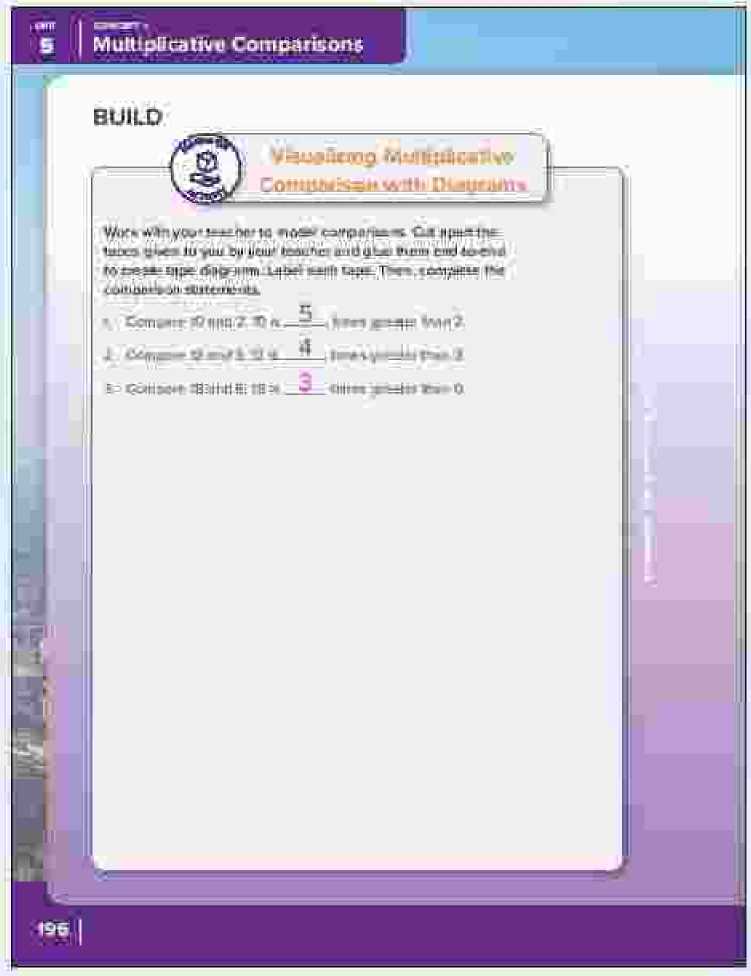
4. Ask students to provide the answer to "How much is two 5s?" Write 10 is two times greater than 5 under the tape diagram and explain that the tape diagram helps us see that 10 is two times greater than 5.

   TEACHER NOTE: Make sure students understand that the "tapes" in the tape diagram represent equal groups. When constructing a tape diagram, each tape should represent the same quantity. Discuss any questions students have at this time.

5. Direct students to Lesson 1 BUILD Visualizing Multiplicative Comparisons with Diagrams. Distribute a set of Student Tapes to each student.

PRINT

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UNIT 5 | Multiplicative Comparisons

BUILD

Visualizing Multiplicative Comparison with Diagrams

Work with your teacher to model comparisons. Cut apart the tapes given to you by your teacher and glue them end-to-end to create tape diagrams. Label each tape. Then, complete the comparison statements.

1. Compare 10 and 2. 10 is 5 times greater than 2.
2. Compare 12 and 3. 12 is 4 times greater than 3.
3. Compare 18 and 6. 18 is 3 times greater than 6.

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6. Work with students to complete the three multiplicative comparison problems. Model how to determine which equal groups to represent. Be sure to allow time for students to cut out the tapes they need and glue them in their Student Materials. Model how to label the tapes with numbers, and then how to compare the numbers (for example, 10 is "2 times greater than" 5).

   Answer Key for Visualizing Multiplicative Comparison with Diagrams:
   1. 5
   2. 4
   3. 3

Multiplicative Comparison with Numbers (25 min)

1. Explain that tape diagrams can be helpful in building understanding of multiplicative comparison, but students have another tool they can use: multiplication facts. Ask students to think about multiplication facts and how they might use multiplication to compare 24 and 4. If students are struggling, ask, "How many times greater than 4 is 24?"
2. After about 30 seconds, have students share their thinking with their Shoulder Partner. If necessary, ask students to help you create a tape diagram. Draw "tapes" on the board to represent the quantity 4. Ask students to help you determine how many tapes you need to draw to equal 24. Ask questions as needed to help students understand that 6 tapes are needed, so 24 is 6 times greater than 24. Write "24 is 6 times greater than 4" on the board.
3. Ask students to share any other strategies they thought of or used for using multiplication relationships to compare 4 and 24.

   TEACHER NOTE: Some students may recognize $4 \times 6 = 24$ as a multiplication fact, while some may have to draw groups of 4 to equal 24 and count the groups (6). Other students may draw 24 tally marks and divide them into groups of 4. Accept all strategies that result in a correct answer.
4. Explain to students that because we know the multiplication fact $6 \times 4 = 24$, we can say that 24 is 6 times greater than 4. Tell students that they just completed a multiplicative comparison of 24 and 4.
5. Direct students' attention to Lesson 1 BUILD Multiplicative Comparison with Numbers. Ask students to work with a partner to complete the problems. Students may draw tape diagrams or use multiplication facts to complete the comparisons but must be able to explain their strategies.
6. After about 15 minutes, go over the answers with students. Clarify any misconceptions. If students are struggling, ask volunteers to model their work at the board.

   Answer Key for Multiplicative Comparison with Numbers:
   1. 5
   2. 4
   3. 3

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CONNECT (5 min)

Writing About Math

1. Ask students to turn to Lesson 1 CONNECT Writing About Math and respond to the prompt.
2. If time allows, ask students to share their ideas with the class.

WRAP-UP (5 min)

Seatbelt Safety Follow-up

1. Remind students of the ACCESS section of the lesson and that your strip of paper is 90 cm long and their strips are 3 cm long.
2. Ask volunteers to come up and tape their strips under your strip. (If there are fewer than 30 students in the class, give students extra strips to bring to the board.) Be sure students are taping the strips directly below yours and connecting them end-to-end.
3. When finished, have students count aloud with you as you count the strips. Confirm that your strip is 30 times greater than their strip. Explain that the tape diagram shows it is 30 times safer riding in a car with a seatbelt than without a seatbelt.

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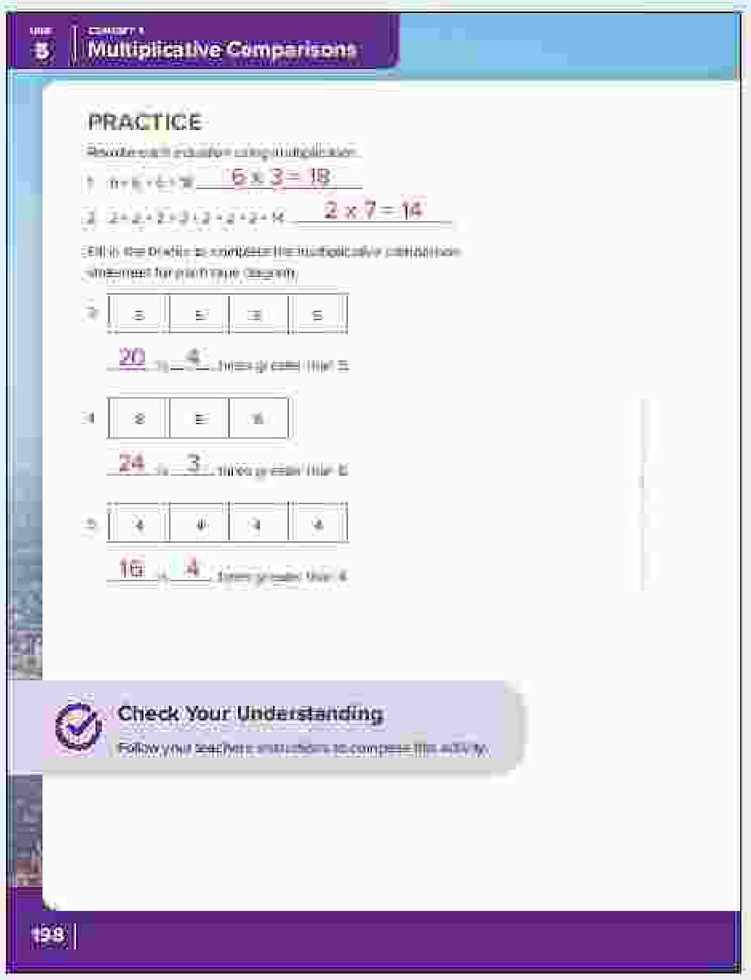
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PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Fill in the blank to complete the multiplicative comparison statement for each tape diagram.

1.

7	7	7	7	7

35 is 5 times greater than 7.

2.

9	9

18 is 2 times greater than 9.

3.

4	4	4

12 is 3 times greater than 4.

4.

6	6	6	5	6	6

36 is 6 times greater than 6.

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LESSON 2
Creating Multiplicative Comparison Equations

Lesson Overview

In this lesson, students build on their understanding of multiplication as a method to compare numbers. Students create equations to represent multiplicative comparison statements.

Lesson Essential Question

- How can multiplication be used to compare numbers?

Learning Objectives

In this lesson

- Students will create equations to represent multiplicative comparison problems.
- Students will use letters to represent unknown quantities in equations.

Grade-Level Standards

4.C.1.a Interpret a multiplication equation as a comparison.

4.C.1.b Represent verbal statements of multiplicative comparisons as multiplication equations.

4.C.1.c Multiply or divide to solve word problems involving multiplicative comparison (for example, using drawings and equations with a symbol for the unknown number to represent the problem).

4.C.1.d.i Use letters in equations to represent unknown quantities.

Vocabulary Check-In

equation, factor, multiplicative comparison, product

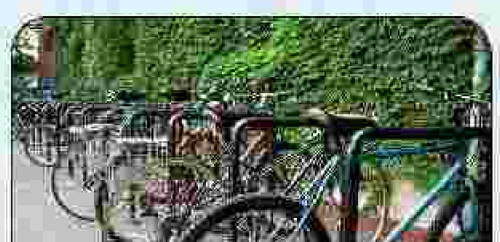
Materials List

- No additional materials needed

Preparation

- No additional preparation needed

DIGITAL



Lesson 2
Creating Multiplicative Comparison Equations

Quick Code: egmt4064

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LESSON 2

Creating Multiplicative Comparison Equations

Quick Code

Learning Targets

ACCESS

Lesson 2: Creating Multiplicative Comparison Equations | 199

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may always write an equation as known × known = unknown, but an equation can also be written as unknown = known × known. Both equations are correct as long as what is on one side of the equal sign is equal to what is on the other.
- Students may incorrectly place the unknown in an equation. For example, if a student is asked to write 12 is 3 times greater than a, they may write $12 \times 3 = a$, instead of $12 = 3 \times a$ or $3 \times a = 12$.

Comparing Transportation Speeds

1. Direct students to Lesson 2 ACCESS Comparing Transportation Speed. Ask volunteers to read aloud the statements in the infographic.
2. Ask students to highlight or circle phrases that show multiplicative comparison. If necessary, review the term.

Answer Key for Comparing Transportation Speeds:

- A sailboat travels about **2 times faster than** a person walking.
- A bicycle travels **3 to 4 times faster than** a sailboat.
- A cruise ship travels about **the same speed as** a fast bicycle and about **8 times the speed of** a person walking.
- A car travels about **20 times faster than** a person walking and more than **twice as fast as** a cruise ship.
- High-speed trains move **8 times faster than** a cruise ship and over **30 times as fast as** a sailboat.
- Passenger airplanes travel nearly **200 times faster than** a person walking, but more than **twice as fast as** a high-speed train.

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BUILD (40 min)

Multiplying to Show Comparisons (25 min)

1. Direct students to Lesson 2 BUILD Multiplying to Show Comparisons.

2. Read Problem 1 aloud and point out the language used to express comparisons (4 times greater than). Explain that there is a number missing in the statement. The missing number is represented by a blank, but we can also use letters to represent missing numbers.

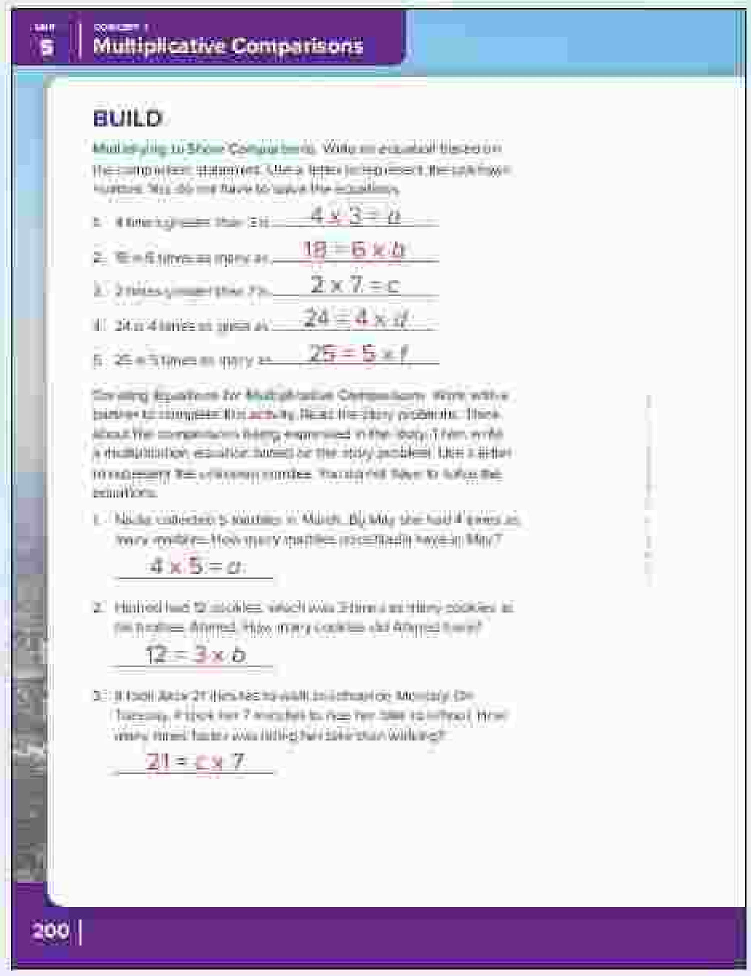
   TEACHER NOTE: Students may know that 12 is the missing number. Bring students' attention back to Primary 3, where they first used symbols to represent unknown quantities. Remind students that even if they know the missing number, today's lesson is about representing an unknown number in a multiplication problem. Tell students they may add the missing number later if they know it.

3. Write on the board: 4 times greater than 3 is *a*. Remind students that the letter represents an unknown or missing number. Ask students to record the information from the board in their books.

4. Ask students to think about times when they have made multiplicative comparison statements (or heard others make them) outside of school. Share an example, such as, "I went out to buy oranges yesterday and one market was selling them for 2 times as much as another market," or, "It took me 15 minutes to get to school yesterday and 3 times longer to get home."

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5. Explain that we often use multiplicative comparisons in our daily lives without realizing it. We can write multiplication statements to represent those comparisons and we can use letters to represent unknown numbers.

6. Write on the board: $4 \times 3 = a$. Guide students to see the connection between use of the word "times" in the multiplicative comparison statement and the development of a multiplication equation.

7. Ask students to look at Problem 2 and think about how this statement is different from Problem 1. Ask students to share their thinking with a partner.

8. Ask for volunteers to share their thinking with the whole group. If necessary, explain that in Problem 2 the product is known and one of the factors is unknown.

9. Write $18 = 6 \times b$ and ask students if they think this is an accurate representation of the multiplicative comparison statement. Allow students to agree or disagree and to share their thinking. Make sure students understand that it does not matter where an equal sign is in an equation as long as what is on one side of the equal sign is equal to what is on the other side.

10. Ask students to work with a partner to complete BUILD problems 3–5.

11. After a few minutes, go over the answers with students. Ask students to share their thinking and to describe the strategies they used to solve the problems.

Answer Key for Creating Equations for Multiplicative Comparison Statements:
See Teacher Note.
3. $2 \times 7 = a$
4. $24 = 4 \times b$
5. $25 = 5 \times c$

TEACHER NOTE: **Throughout this unit and moving forward, accept as correct all variations of the equations.** For example, for problem 3 in BUILD, accept as correct $2 \times 7 = a$; $7 \times 2 = a$; $a = 2 \times 7$; $a = 7 \times 2$. Each of these answers indicates that students understand the multiplicative relationships in the problem. Additionally, students may use any letter to represent unknowns in equations.

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Creating Equations for Multiplicative Comparison Statements (15 min)

1. Direct students to Lesson 2 BUILD Creating Equations for Multiplicative Comparison Statements. Go over the directions with students and give them time to work with a partner. (Students do not have to solve the equations.)
2. As students work, walk around the room to monitor their progress. Ask questions to guide their thinking, such as
   - What information does the problem give us?
   - What is the unknown?
   - What equation can we use to represent the multiplicative comparison?
3. At the end of BUILD, go over the answers with students. Ask students to share their thinking and the strategies they used.

Answer Key for Creating Equations for Multiplicative Comparison Statements:

1. $4 \times 5 = a$
2. $12 = 3 \times b$
3. $21 = c \times 7$

CONNECT (7 min)

Exit Ticket

Ask students to turn to Lesson 2 CONNECT Exit Ticket and respond to the prompt.

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CONNECT

Exit Ticket: Imagine a car is 3 times faster than a bicycle. It takes Salma 24 minutes to get to school by bicycle. Write a multiplication equation that shows how long it would take Salma to get to school by car. Use a letter to represent the unknown number. Use words, numbers, or pictures to explain your thinking. You do not have to solve the equation.

Answers may vary, but should include some form of the equation $24 = 3 \times a$.



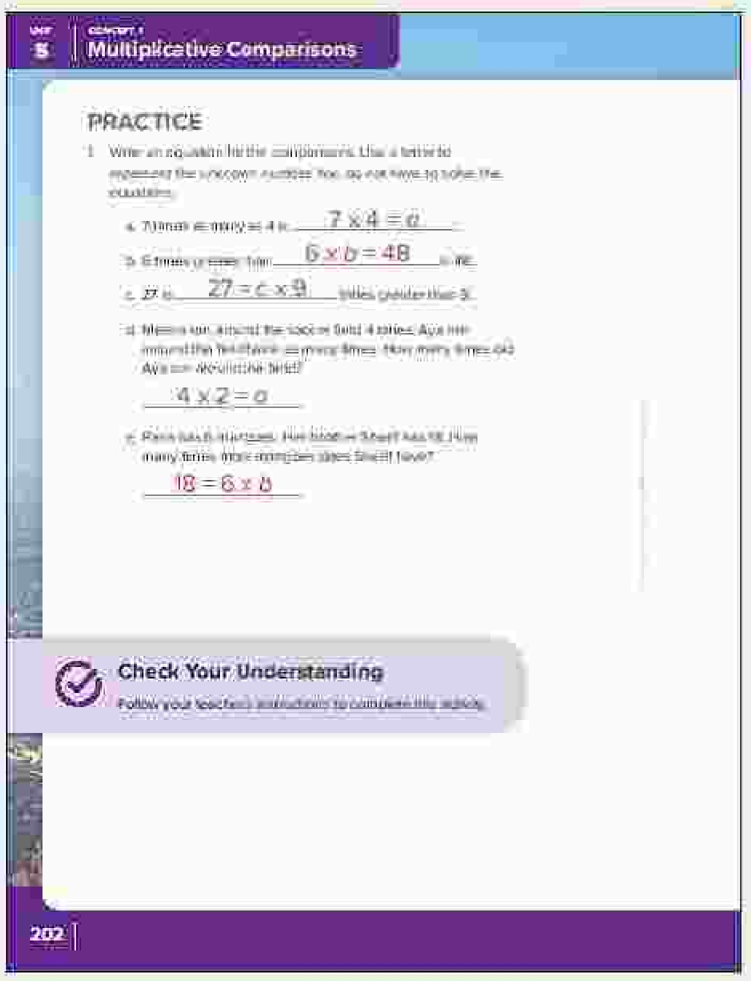
Bicycles Parked in a Bike Rack

Lesson 2: Creating Multiplicative Comparison Equations | 201

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WRAP-UP (3 min)

Let's Chat About Our Learning

Ask student volunteers to share their answers, explain their thinking, and model their problem-solving strategy.

TEACHER NOTE: Students' equations may or may not include an unknown. Ask students who use an unknown to describe what it represents. Ask students who use 8 to explain how they knew that was the missing number. Accept all equations that are a variation of $3 \times b = 24$ or $24 = 3 \times 8$. If you do not have time to go over answers, consider collecting Student Editions to review students' answers and check their understanding.

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Write an equation for the comparisons. Use a letter to represent the unknown number. You do not have to solve the equations.

1. 16 is 4 times greater than $16 = 4 \times a$
2. 4 times as many as 5 is $4 \times 5 = b$
3. Rashad's team scored 9 goals in soccer. This is 3 times as many goals as Yaseen's team scored. How many goals did Yasseen's team score?
   $9 = 3 \times c$

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LESSON 3
Solving Multiplicative Comparison Equations

Lesson Overview

In this lesson, students create and solve multiplicative comparison equations. Just as in the previous lesson, it is important to note that the unknown can be in different positions in the equation.

Essential Question

- How can multiplication be used to compare numbers?

Learning Objective

In this lesson

- Students will create and solve multiplicative comparison equations.

Grade-Level Standards

4.C.1.b Represent verbal statements of multiplicative comparisons as multiplication equations.

4.C.1.c Multiply or divide to solve word problems involving multiplicative comparison (for example, using drawings and equations with a symbol for the unknown number to represent the problem).

Vocabulary Check-In

inverse

Materials List

- No additional materials needed

Preparation

- No additional preparation needed

DIGITAL



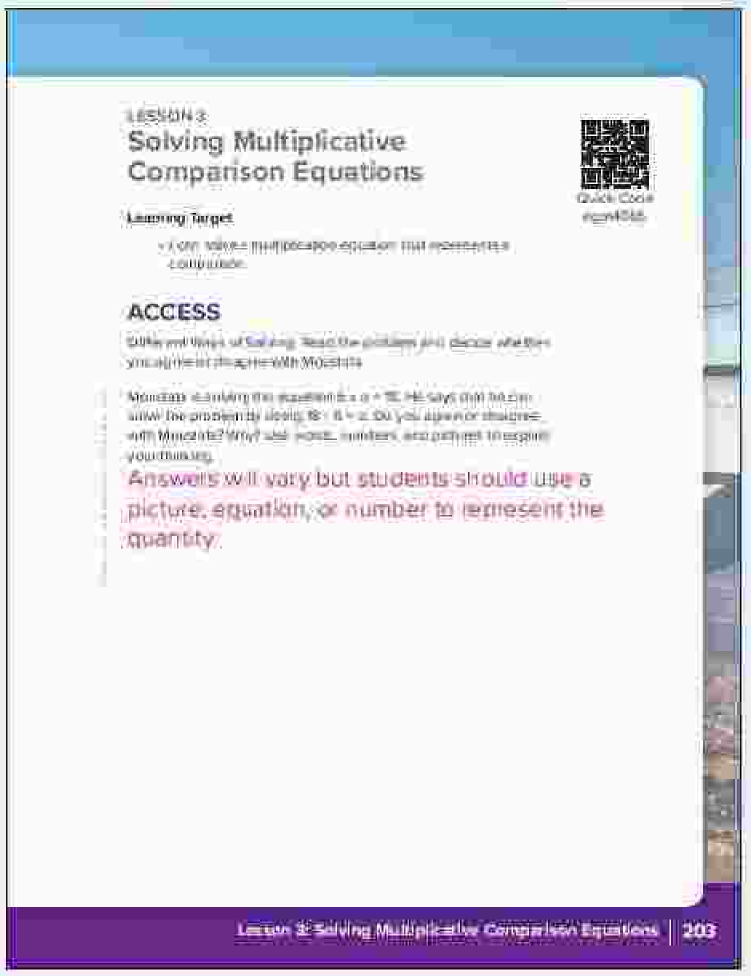
Lesson 3
Solving Multiplicative Comparison Equations

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LESSON 3

Solving Multiplicative Comparison Equations

Quick Code

Learning Target

- I can solve a multiplication equation that represents a comparison.

ACCESS

Different Ways of Solving. Read the problem and decide whether you agree or disagree with Moustafa.

Moustafa is solving the equation $6 \times a = 18$. He says that he can solve the problem by doing $18 \div 6 = a$. Do you agree or disagree with Moustafa? Why? Use words, numbers, and pictures to explain your thinking.

Answers will vary but students should use a picture, equation, or number to represent the quantity.

Lesson 3: Solving Multiplicative Comparison Equations | 203

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have trouble creating their own comparison statement and equation using the information provided.
- Students may not recognize that multiplication and division facts can inform the relationships they are exploring.

Different Ways of Solving

1. Direct students to Lesson 3 ACCESS Different Ways of Solving. Read the problem with students and ask them to record their responses and explanations.
2. Ask students to put a thumb up if they agree, a thumb down if they disagree, and a thumb to the side if they are unsure. Allow students with thumbs to the side to select students with thumbs up or thumbs down to explain their thinking to the class. If students do not recall the relationship between multiplication and division and of their work with fact families in Primary 3. Explain that multiplication and division are inverse operations so both equations are correct.

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BUILD (40 min)

How Many Seats? (40 min)

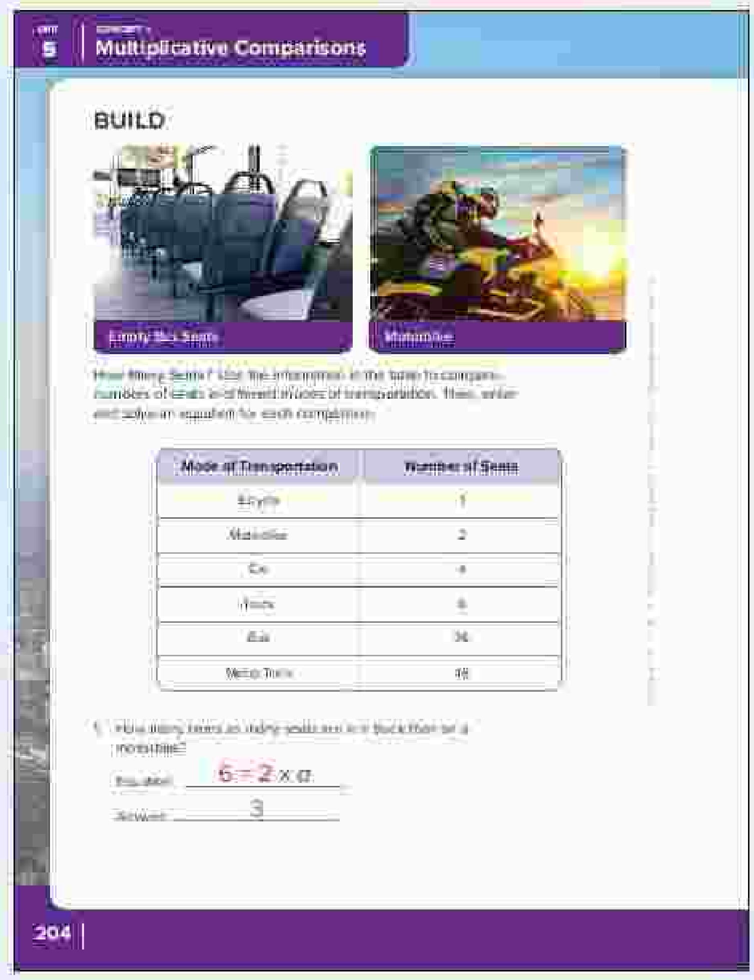
1. Ask students how many times as many seats are in a car than on a bicycle. Ask students to help you solve the problem by providing the following prompts.
   - How many seats are in a typical car?
   - How many seats are on a typical bicycle?
   - Which has more seats?
   - What multiplicative comparison statement could we use?
   - What equation can we use? (Possible answer $1 \times a = 4$)
2. Explain to students that when they solve an equation, they say or write what the unknown number is. Encourage students to try to solve equations from memory using multiplication facts. However, students may also continue to use the strategies they have learned to solve multiplication problems as needed.
3. Direct students to Lesson 3 BUILD How Many Seats? Ask students to examine the information in the table. Instruct students to work with a partner to write and solve an equation that can be used to answer each question.
4. With about 10 minutes left in BUILD, have students share their equations and their solutions.

Answer Key for How Many Seats?:

1. $6 = 2 \times a$; 3
2. $36 = b \times 6$; 6
3. $48 = c \times 4$; 12
4. $48 = d \times 6$; 8
5. $36 = e \times 4$; 9

PRINT

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UNIT 5 | CONCEPT 1
Multiplicative Comparisons

BUILD

Empty Bus Seats

Motorbike

Mode of Transportation	Number of Seats
Bicycle	1
Motorcycle	2
Car	4
Truck	6
Bus	36
Metro Train	48

Equation: $6 = 2 \times a$

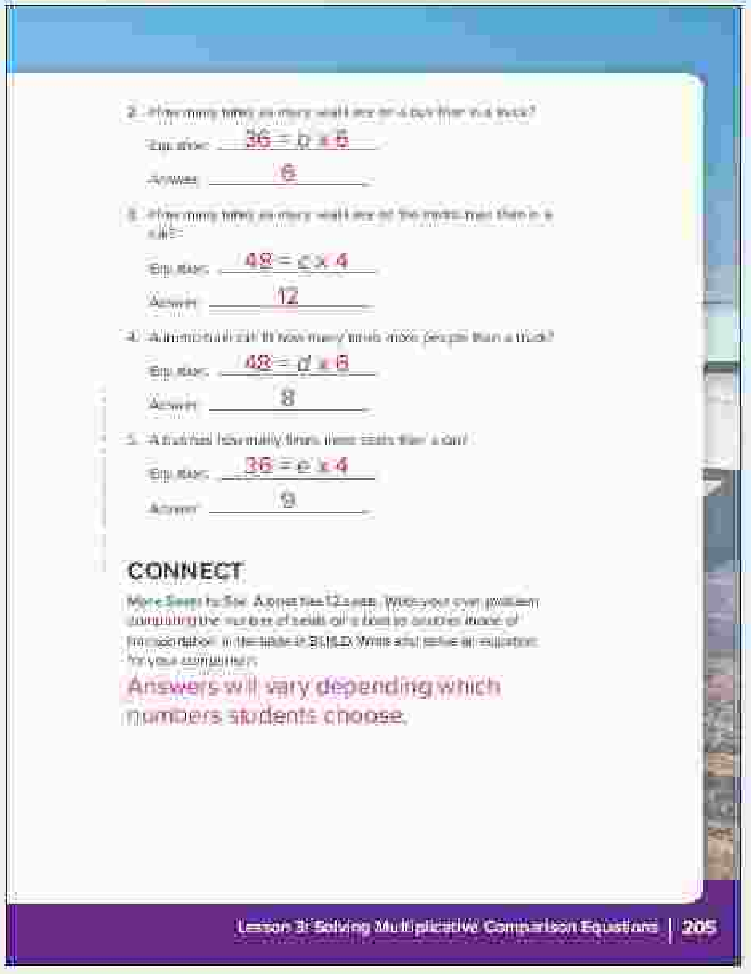
Answer: 3

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Equation: $36 = b \times 6$

Answer: 6

Equation: $48 = c \times 4$

Answer: 12

Equation: $48 = d \times 6$

Answer: 8

Equation: $36 = e \times 4$

Answer: 9

CONNECT

Answers will vary depending which numbers students choose.

Lesson 3: Solving Multiplicative Comparison Equations | 205

CONNECT (7 min)

More Seats to Sail

Direct students to Lesson 3 CONNECT More Seats to Sail. Ask students to work independently to write and solve their own comparison using the information provided.

TEACHER NOTE: Consider using this problem as a formative assessment to determine which students may need additional instruction or support.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share the comparisons they wrote with the class. Allow several students to share their work and explanations. Encourage students to ask each other questions to clarify their understanding.

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PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

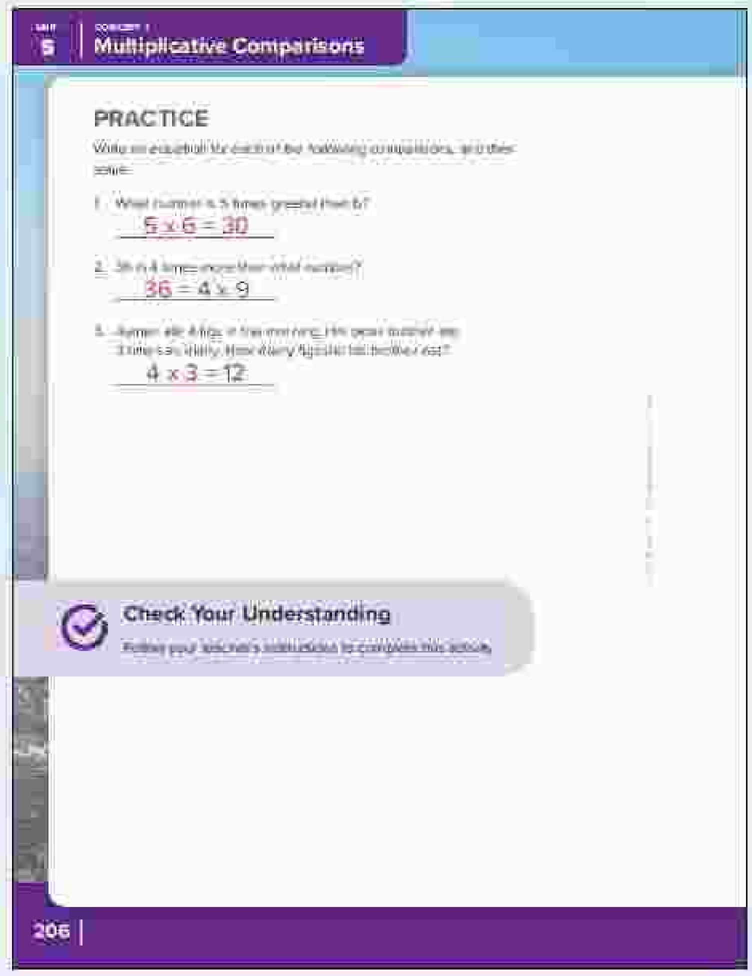
Check Your Understanding

Write an equation for each of the following comparisons, and then solve.

1. What number is 4 times as many as 8?
   32; $4 \times 8 = 32$
2. 42 is 6 times greater than what number?
   7; $6 \times 7 = 42$
3. A car is about 5 meters long. A bus is about 15 meters long. About how many times longer is a bus than a car?
   3; $5 \times 3 = 15$

PRINT

Student Page 206


UNIT 5 | CONCEPT 1
Multiplicative Comparisons

PRACTICE

1. $5 \times 6 = 30$
2. $36 = 4 \times 9$
3. $4 \times 3 = 12$

Check Your Understanding

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Materials List

- Materials will vary

Preparation

- Materials will vary

DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4066

Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Unit 5 Concept 1: Multiplicative Comparisons. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Question

- How can multiplication be used to compare numbers?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to multiplicative comparisons.

Grade-Level Standards

4.C.1.a Interpret a multiplication equation as a comparison.

4.C.1.b Represent verbal statements of multiplicative comparisons as multiplication equations.

4.C.1.c Multiply or divide to solve word problems involving multiplicative comparison (for example, using drawings and equations with a symbol for the unknown number to represent the problem).

Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- Students may have difficulty building conceptual understanding of a number being x times greater than another number.
- Students may always write an equation as known × known = unknown, but an equation can also be written as unknown = known × known. Both equations are correct as long as what is on one side of the equal sign is equal to what is on the other.
- Students may incorrectly place the unknown in an equation. For example, if a student is asked to write 12 is 3 times greater than a, they may write $12 \times 3 = a$, instead of $12 = 3 \times a$.
- Students may have trouble creating their own comparison statement and equation using the information provided.

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Remediation: Correcting Misconceptions

If...	Then...
Students are having difficulty building conceptual understanding of a number being x times greater than another number.	Use manipulatives to help them build multiplicative comparisons. For example, have students create a group of 6 counters and a group of 12 counters. Ask them to investigate "how many times" they can make a group of 6 out of the 12. Connect making 2 groups of 6 to 12 being 2 times greater than 6. Repeat with other math facts. Reiterate the importance of creating equal groups to make multiplicative comparisons.
If... Students have trouble writing equations correctly to represent multiplicative comparisons.	**Then...** Review Multiplying to Show Comparisons from Lesson 2. Consider building on the manipulative activity to have students record the relationships that they are seeing. For example, after students build a group of 6 and a group of 12 and identify the multiplicative relationship, they can record the numbers they used—6, 2, and 12—to form a multiplication equation. It may be helpful to start with smaller numbers and familiar multiplication facts.
If... Students do not understand how to use letters to represent unknowns in equations.	**Then...** Review Multiplying to Show Comparisons from Lesson 2. Build on the manipulative activity by having students record the quantities they are seeing and using a letter written on a small piece of paper to represent the number they are solving for. Remind students that the letter is just a placeholder. Explain that it is easier to use letters as placeholders than numbers because numbers would be confusing.

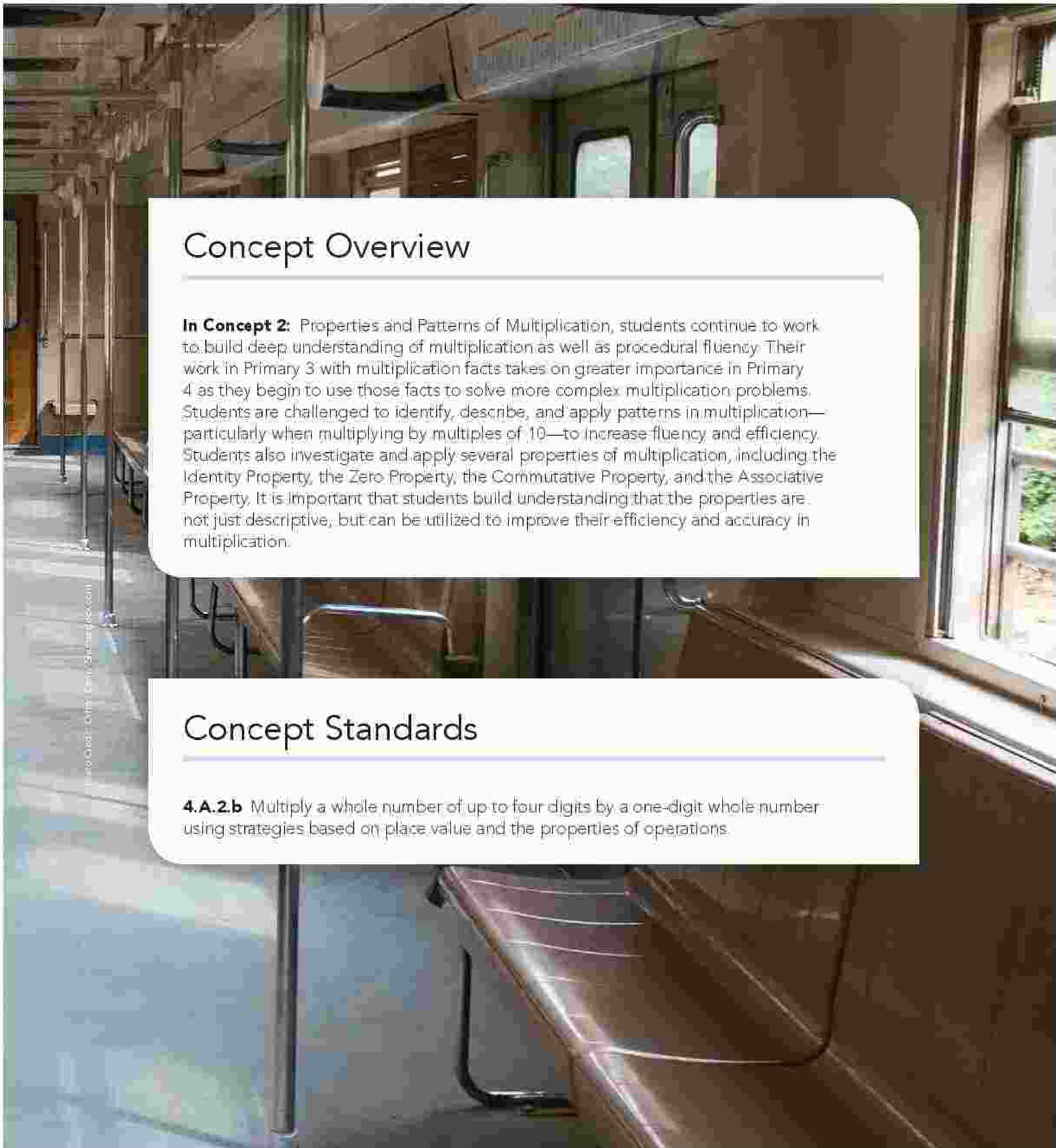
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CONCEPT
2

Properties and Patterns of Multiplication

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Concept Overview

In Concept 2: Properties and Patterns of Multiplication, students continue to work to build deep understanding of multiplication as well as procedural fluency. Their work in Primary 3 with multiplication facts takes on greater importance in Primary 4 as they begin to use those facts to solve more complex multiplication problems. Students are challenged to identify, describe, and apply patterns in multiplication—particularly when multiplying by multiples of 10—to increase fluency and efficiency. Students also investigate and apply several properties of multiplication, including the Identity Property, the Zero Property, the Commutative Property, and the Associative Property. It is important that students build understanding that the properties are not just descriptive, but can be utilized to improve their efficiency and accuracy in multiplication.

Concept Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
4 Commutative Property of Multiplication	• Digit cards 1–9 from Unit 1 (1 set per student) • Markers or crayons • Extra graph paper (Optional)	Array Column Commutative Property of Multiplication Factor Horizontal Product Row Vertical	• Students will explain the Commutative Property of Multiplication. • Students will apply the Commutative Property of Multiplication to solve problems.	
5 Patterns of Multiplying by 10s	• No additional materials needed	Identity Property of Multiplication Zero Property of Multiplication	• Students will apply the Identity Property of Multiplication to solve problems. • Students will apply the Zero Property of Multiplication to solve problems. • Students will identify patterns that occur when multiplying by 10, 100, and 1,000.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may not be used to seeing an equal sign without writing an answer. In this lesson, students see factors on one side of the equal sign and then change their order on the other side to show the Commutative Property of Multiplication, but do not write the product. • Students often think that an unknown in a multiplication equation is always the product. An unknown may also be one of the factors.	Exploring the Commutative Property of Multiplication, Writing About Math, Practice, Check Your Understanding
	• Students may get confused with how many 0s to place at the end of a product. For example, students may write $6 \times 10 = 600$ instead of $6 \times 10 = 60$.	Place Value Patterns, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives
6 Review Exploring Patterns in Multiplication	• 9 Spinner (1 per small group) (Photocopy the Blackline Master at the end of this volume.) • Paperclip (1 per group) • Scissors (1 per group)	Multiples	• Students will apply place value concepts to multiply by multiples of 10,100, and 1,000. • Students will explain patterns when multiplying by multiples of 10, 100, and 1,000.
7 Exploring More Patterns in Multiplication	• No additional materials needed	Associative Property of Multiplication Commutative Property of Multiplication Parentheses	• Students will explain the Associative Property of Multiplication. • Students will apply the Associative Property of Multiplication to solve problems.
8 Applying Patterns in Multiplication	• Digit Cards 0–9 (optional)	Decompose Factors Multiples	• Students will apply decomposing and the Associative Property of Multiplication to solve equations with multiples of 10, 100, or 1,000.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may get confused with how many 0s to place at the end of a product. For example, students may write 6 × 30 = 1,800 instead of 6 × 30 = 180. • Students may get confused when multiplying by a factor with 5 as the leading digit since the product may end in a 0 already. As a result, they may place the incorrect number of zeros to their answer. For example, when multiplying 5 × 400, students may write 5 × 400 = 200.	Writing About Math, Practice, Check Your Understanding
	• Students may have trouble strategically identifying two factors to multiply first in a problem and always attempt to multiply the factors in the order they are presented making the problem more difficult to solve.	Applying the Associative Property of Multiplication, Writing About Math, Practice, Check Your Understanding
	• Students may factor the multiple of ten into a factor pair that is less efficient to use when applying the Associative Property of Multiplication. This is not actually an error in computation. For example, thinking of 300 as 3 × 100 is helpful in solving these problems while thinking of 300 as 5 × 60 is correct but less efficient in this lesson. • Students may have difficulty applying the properties and patterns they learned in previous lessons to multiplying a two-digit number by 10, 100, or 1,000. When multiplying 27 × 100, students should recognize 27 × 1 = 27 and place two zeroes in the product.	Multiplying by Multiples of 10, 100, and 1,000, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials will vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to properties and patterns of multiplication.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may get confused with how many 0s to place at the end of a product. For example, students may write 6 × 10 = 600 instead of 6 × 10 = 60. • Students may get confused when multiplying by a factor with 5 as the leading digit since the product may end in a 0 already. As a result, they may place the incorrect number of zeros to their answer. For example, when multiplying 5 × 400, students may write 5 × 400 = 200. • Students may have trouble strategically identifying two factors to multiply first in a problem and always attempt to multiply the factors in the order they are presented making the problem more difficult to solve. • Students may have difficulty applying the properties and patterns they learned in previous lessons to multiplying a two-digit number by 10, 100, or 1,000.	Concept Check-In

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LESSON 4
Commutative Property of Multiplication

Lesson Overview

In this lesson, students review the concept of the Commutative Property of Multiplication and apply this property to solve equations. Students continue to use a letter to represent an unknown number and interpret their meaning in equations showing the Commutative Property of Multiplication.

Lesson Essential Question

- How can understanding properties and patterns in multiplication help us solve problems more efficiently?

Learning Objectives

In this lesson

- Students will explain the Commutative Property of Multiplication.
- Students will apply the Commutative Property of Multiplication to solve problems.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

array, column, Commutative Property of Multiplication, factor, horizontal, product, row, vertical

Materials List

- Digit cards 1–9 from Unit 1 (1 set per student)
- Markers or crayons
- Extra graph paper (Optional)

Preparation

- No advance preparation needed

DIGITAL



Lesson 4
Commutative Property of Multiplication

Quick Code: egmt4067

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5 | Properties and Patterns of Multiplication

LESSON 4

Commutative Property of Multiplication

Learning Targets

ACCESS

Toy Cars

Answers will vary, but should include a drawing representing one of the following arrays: 1 × 48, 2 × 24, 3 × 16, 4 × 12, 6 × 8, 8 × 6, 12 × 4, 16 × 3, 24 × 2, or 48 × 1.

Lesson 4: Commutative Property of Multiplication | 209

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may not be used to seeing an equal sign without writing an answer. In this lesson, students see factors on one side of the equal sign and then change their order on the other side to show the Commutative Property of Multiplication, but do not write the product.
- Students often think that an unknown in a multiplication equation is always the product. An unknown may also be one of the factors.

Toy Car Number Talk

1. Direct students to Lesson 4 ACCESS Toy Car Number Talk. Present the problem and give students time to solve it. Tell students to give a Thumbs Up when they are finished.
2. As students work, walk around, and look for students who designed arrays that show 6 rows and 8 columns or 8 rows and 6 columns. Ask these students to draw their solutions on the board and explain their thinking.
3. Ask students to talk with a partner about what they notice in these solutions. Use these questions to guide their conversations.

ASK

- *Do you agree with these solutions?*
- *What is the same? What is different?*
- *Are there other ways to display the toy cars?*
  (Possible solutions 2 × 24, 3 × 16, 4 × 12)

4. Ask students to share their thinking with the group. Record on the board other ways students design to display the toy cars.

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BUILD (40 min)

Exploring the Commutative Property of Multiplication (10 min)

1. Direct students to Lesson 4 BUILD Exploring the Commutative Property of Multiplication. Ask students to Turn and Talk about what they remember about the Commutative Property of Multiplication. Ask students to record a definition in their own words and an example in the BUILD section for this lesson.

   TEACHER NOTE: This should be review. If necessary, remind students that a property is a characteristic of an operation and that the Commutative Property of Multiplication states that factors can be multiplied together in any order and the product will always be the same. If students are familiar with the word "commute" meaning to move around or to travel back and forth, you may choose to connect this to the idea of the factors moving around in the problem.

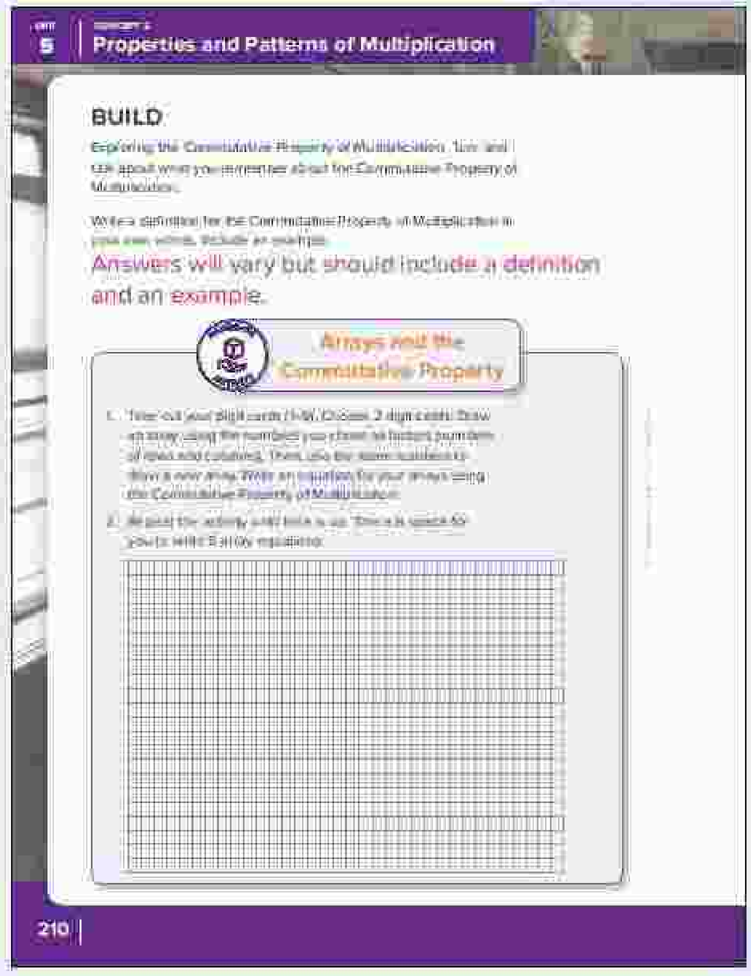
2. Tell students that they will be applying the Commutative Property of Multiplication by drawing arrays. An array arranges objects into rows and columns. Rows are horizontal (left-right) and columns are vertical (up-down). Each row has the same number of objects and each column has the same number of objects.

Arrays and the Commutative Property (30 min)

1. Direct students to Arrays and the Commutative Property in BUILD. Ask students to take out their digit cards (1–9) and choose 2 cards.
2. Go over the directions with students to make sure they understand the learning activity.
3. Allow time for students to draw their first pair of arrays and write their first equation. As students work, walk around, and monitor their progress. Offer support to students who are struggling. If many students are struggling, consider having students work in pairs or small groups.
4. At the end of BUILD, ask student volunteers to share their work on the board. Encourage students to ask each other questions to build understanding or clarify misconceptions.

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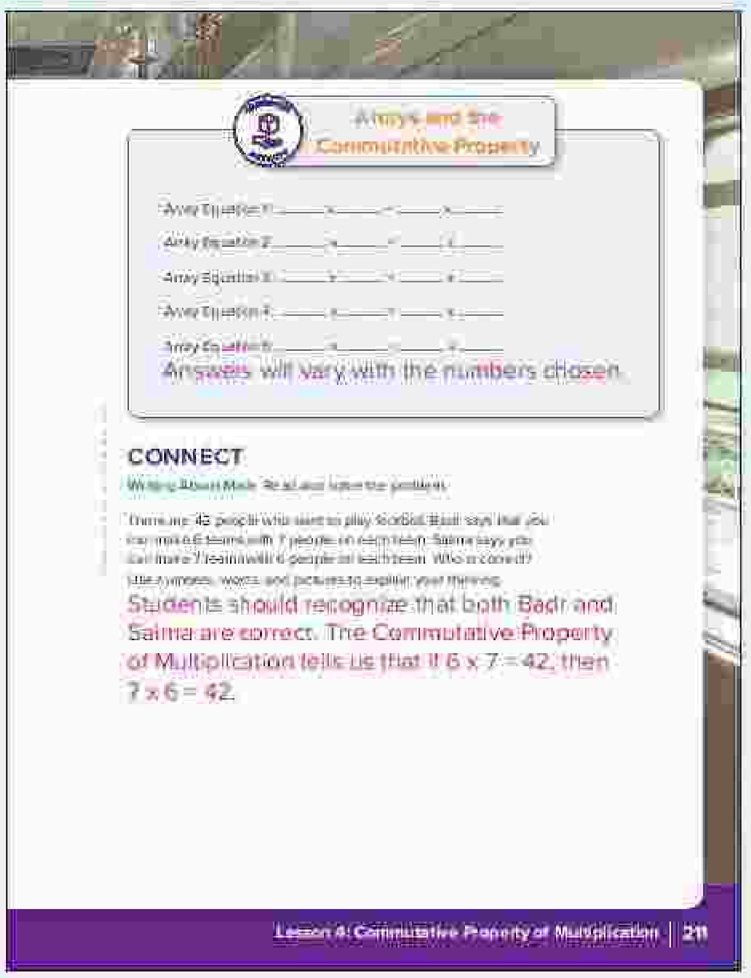


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Arrays and the Commutative Property

Array Equation 1: ____ × ____ = ____ × ____

Array Equation 2: ____ × ____ = ____ × ____

Array Equation 3: ____ × ____ = ____ × ____

Array Equation 4: ____ × ____ = ____ × ____

Array Equation 5: ____ × ____ = ____ × ____

Answers will vary with the numbers chosen.

CONNECT

Writing About Math Read and solve the problem.

There are 42 people who want to play football. Badr says that you can make 6 teams with 7 people on each team. Salma says you can make 7 teams with 6 people on each team. Who is correct? Use numbers, words, and pictures to explain your thinking.

Students should recognize that both Badr and Salma are correct. The Commutative Property of Multiplication tells us that if $6 \times 7 = 42$, then $7 \times 6 = 42$.

Lesson 4: Commutative Property of Multiplication | 211

CONNECT (5 min)

Writing About Math

1. Write the terms factor, multiply, product, equation, array, and Commutative Property of Multiplication, row, and column on the board.
2. Ask students to turn to Lesson 4 CONNECT Writing About Math and respond to the prompt. Encourage students to use mathematical vocabulary in their response.
3. After a few minutes, ask students to share their thinking with a partner.

WRAP-UP (5 min)

What About Three?

1. Write on the board: $2 \times 5 \times 3 =$ ______. Ask students to share the product with their Shoulder Partner.
2. Ask students if they will get the same product if the factors are moved around. Discuss. **Do not ask students to agree on a conclusion at this time.** Explain that they will be confirming or revising their thinking in an upcoming lesson.

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PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Apply the Commutative Property of Multiplication to complete each equation.

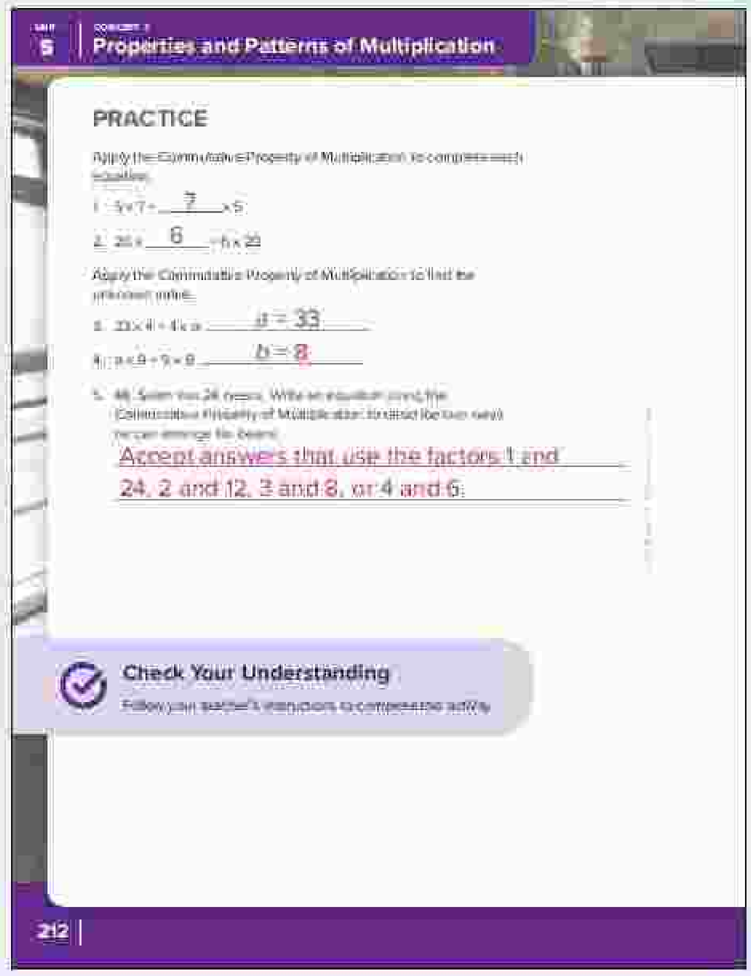
1. $4 \times 6 = 6 \times 4$
2. $18 \times 3 = 3 \times 18$

Apply the Commutative Property of Multiplication to find the unknown value.

3. $5 \times a = 7 \times 5 \quad a = 7$
4. $9 \times 8 = 8 \times b \quad b = 9$
5. Lamiaa has 40 books. Write an equation using the Commutative Property of Multiplication to describe two ways she can arrange her books.
   Accept answers that use the factors 1 and 40, 2 and 20, 4 and 10, or 5 and 8.

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5 | Properties and Patterns of Multiplication

PRACTICE

1. ___7___
2. ___6___

3. $a = 33$
4. $b = 8$

5. Accept answers that use the factors 1 and 24, 2 and 12, 3 and 8, or 4 and 6.

Check Your Understanding

212



Materials List

- No additional materials needed

Preparation

- No advance preparation needed

DIGITAL



Lesson 5

Patterns of Multiplying by 10s

Quick Code:
egmt4068

LESSON 5
Patterns of Multiplying by 10s

Lesson Overview

In this lesson, students apply the Zero Property and the Identity Property of Multiplication and relate their understanding of multiplication and place value to identify patterns when factors are multiplied by 10, 100, and 1,000. Identifying patterns and relationships helps develop mathematical thinking and enables students to compute mentally and with efficiency.

Lesson Essential Questions

- How does identifying patterns in multiplication problems help us to solve problems more efficiently?
- How does understanding place value help me to solve multiplication problems?

Learning Objectives

In this lesson

- Students will apply the Identity Property of Multiplication to solve problems.
- Students will apply the Zero Property of Multiplication to solve problems.
- Students will identify patterns that occur when multiplying by 10, 100, and 1,000.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

Identity Property of Multiplication, Zero Property of Multiplication

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

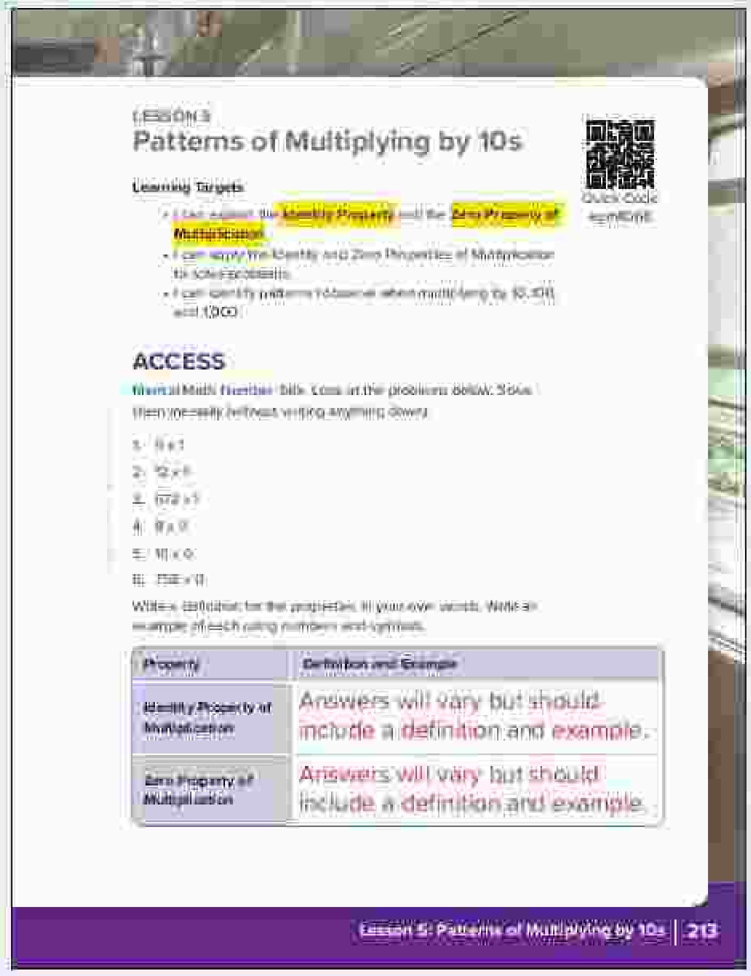
- Students may get confused about how many 0s to place at the end of a product. For example, students may write 6 × 10 = 600 instead of 6 × 10 = 60.

Mental Math Number Talk

1. Direct students to Lesson 5 ACCESS Mental Math Number Talk. Ask students to solve each problem mentally, raising their hands when they know the answer. Ask volunteers to share their answers with the class.
2. Ask students to Turn and Talk about why they were able to solve these problems mentally. Encourage students to think about the meaning of these problems and what they would look like if they drew them.
3. Invite students to share their thinking with the class. Encourage students to use words such as factor, product, array, rows, columns, and groups in their explanations (for example, 5 groups of 1, 1 row of 5, 8 groups of 0, and so on).
4. Remind students that any number multiplied by 1 equals the same number and that this is called the Identity Property of Multiplication. Remind students that any number multiplied by 0 equals 0 and that this is called the Zero Property of Multiplication.
5. Ask students to write a definition and an example of each property in their Student Materials.

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Patterns of Multiplying by 10s

Learning Targets

ACCESS

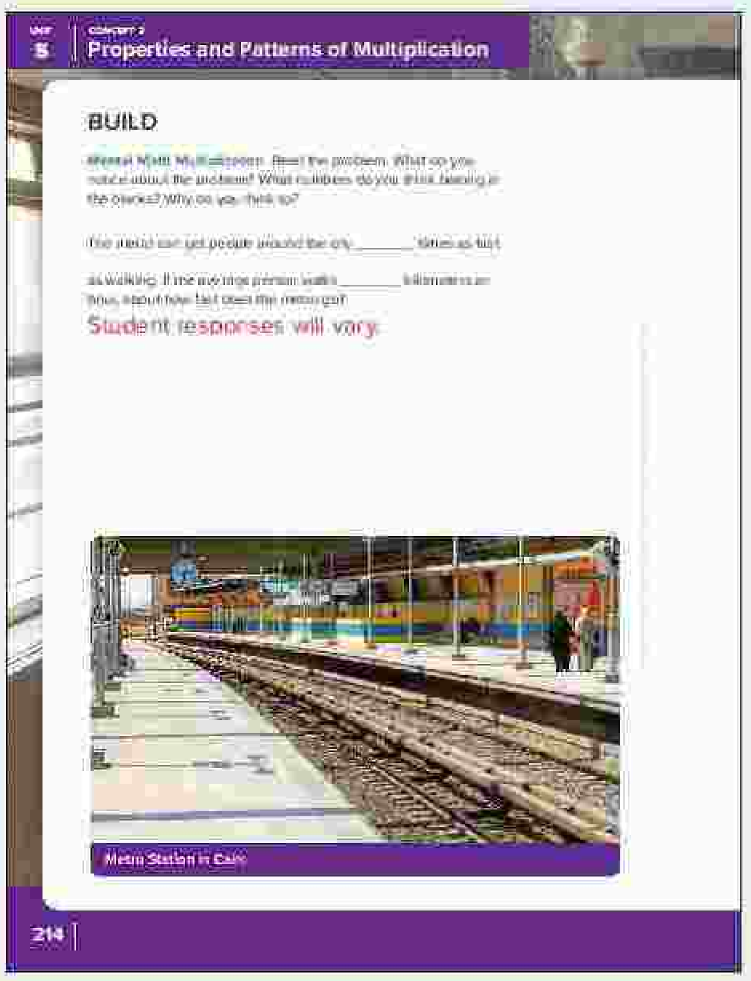
Property	Definition and Example
Identity Property of Multiplication	Answers will vary but should include a definition and example.
Zero Property of Multiplication	Answers will vary but should include a definition and example.

Lesson 5: Patterns of Multiplying by 10s | 213



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UNIT 5 | CONCEPT 2
Properties and Patterns of Multiplication

BUILD

Mental Math Multiplication: Read the problem. What do you notice about the problem? What numbers do you think belong in the blanks? Why do you think so?

The metro can get people around the city ______ times as fast as walking. If the average person walks ______ kilometers an hour, about how fast does the metro go?

Student responses will vary.

Metro Station in Cairo

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BUILD (40 min)

Mental Math Multiplication (15 min)

1. Ask students to turn to Lesson 5 BUILD Mental Math Multiplication. Ask students to discuss with the whole group what they notice about the problem and what numbers they think should go in the blanks.
2. Ask students to discuss how the problem is like the multiplicative comparison problems they solved in previous lessons.
3. Tell students the missing information in the problem.
   - The metro is 10 times as fast as walking.
   - The average person walks 5 kilometers an hour.
4. Ask students what mental math strategies they would use to solve the problem. Ask student volunteers to model their strategies for the class.

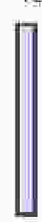
   TEACHER NOTE: Some students may know the math fact 5 × 10, some might skip count by 10 five times, and others may know to add a 0 to the 5 because they multiplied by 10. Accept and discuss all accurate strategies. If no students mention multiplication or skip counting, model those strategies on the board.

Place Value Patterns (25 min)

1. Review place value with students. Ask students to recall how to draw Ones, Tens, Hundreds, and Thousands on a place value chart.
   - Ones – tiny square

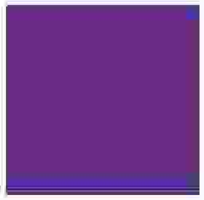
     

   - Tens – rod

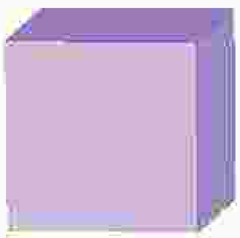
     

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- Hundreds – large square



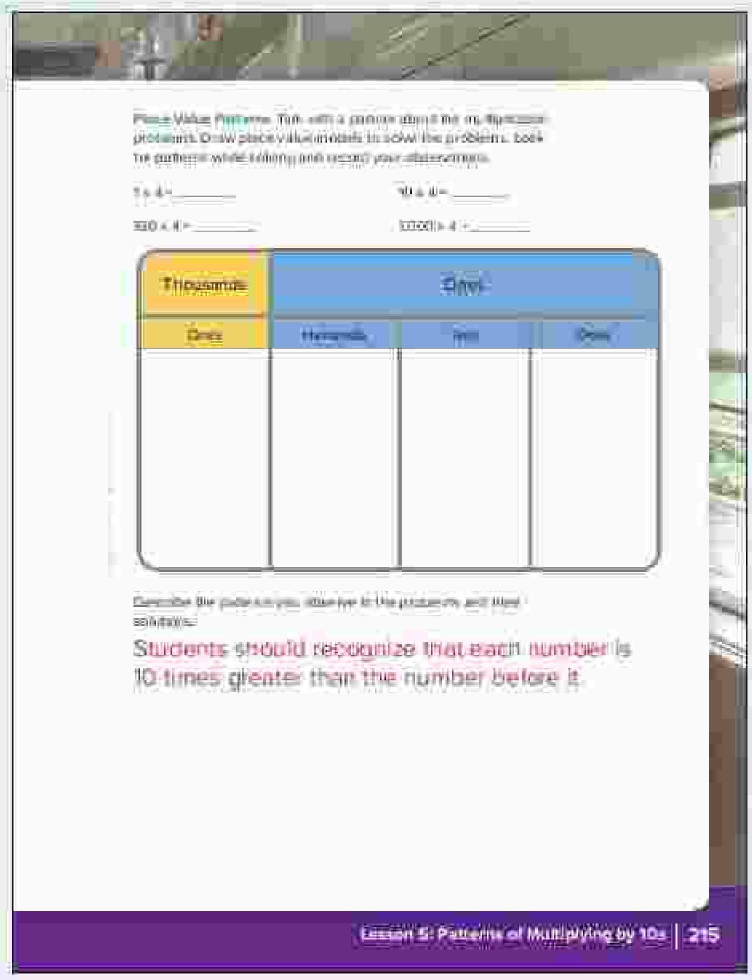
- Thousands – cube



2. Direct students to Lesson 5 BUILD Place Value Patterns. Ask students to work with their Shoulder Partner to draw place value models to solve the problems. Remind students to look for patterns in the problems and solutions.
3. When most students are finished, regroup the whole class. Ask questions to extend students' thinking about the problems they solved, including the following, recording students' thinking on the board.
    - *What patterns did you see in your place value drawings?*
    - *What patterns did you observe between the problems and their solutions?*
    - *Based on the patterns you observed what other strategies could you use to solve these problems mentally?*
4. Ask students to think about the mathematics concepts they explored today: the Identity Property, the Zero Property, and multiplying by 10 or multiples of 10. Engage students in a whole group discussion. Ask the following questions, clarifying misconceptions and errors as needed.
    - *What did these concepts have in common?*
    - *Why do you think we learned about these properties and patterns today?*
    - *How can knowing these properties and patterns help you solve multiplication problems mentally?*
    - *What other properties or patterns do you know that might help you solve multiplications quickly and efficiently?*

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Thousands	Ones		
Ones	Hundreds	Tens	Ones

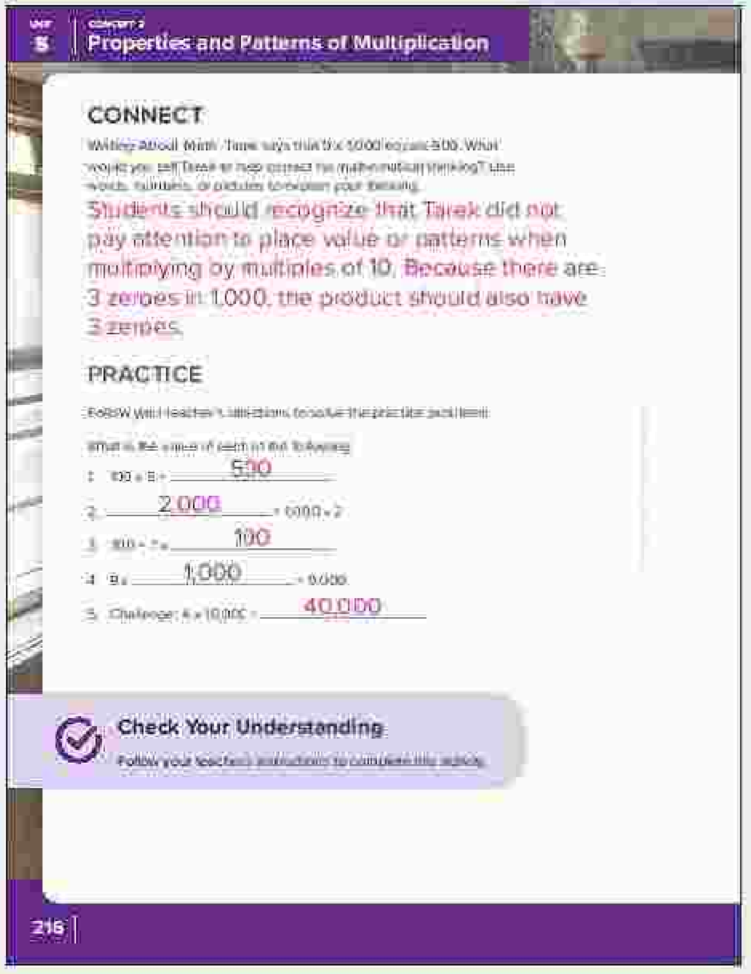
Students should recognize that each number is 10 times greater than the number before it.

Lesson 5: Patterns of Multiplying by 10s | 215



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UNIT 5 | CONCEPT 2

Properties and Patterns of Multiplication

CONNECT

Writing About Math: Tarek says that 5 × 1,000 equals 500. What would you tell Tarek to help correct his mathematical thinking? Use words, numbers, or pictures to explain your thinking.

Students should recognize that Tarek did not pay attention to place value or patterns when multiplying by multiples of 10. Because there are 3 zeroes in 1,000, the product should also have 3 zeroes.

PRACTICE

Follow your teacher's directions to solve the practice problems.

What is the value of each of the following:

1. 100 × 5 = 500
2. 2,000 = 1,000 × 2
3. [illegible] = 100
4. 9 × 1,000 = 9,000
5. Challenge: 4 × 10,000 = 40,000

Check Your Understanding

Follow your teacher's instructions to complete this activity.

216

CONNECT (7 min)

Writing About Math

Direct students to CONNECT Writing About Math and ask them to respond to the prompt. Encourage students to use the mathematical terms they learned today to support their explanations.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to share their Writing About Math entries. Encourage them to use appropriate mathematical terminology to support their thinking.
2. If necessary, explain that knowing properties of multiplication and recognizing patterns makes it easier to solve multiplication efficiently. It also helps us to understand relationships between numbers, especially when working with larger numbers.

PRACTICE

Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. A person can walk about 5 kilometers an hour. The average plane flies 100 times faster than that in the air. How fast can the average plane fly?
   500 kilometers an hour
2. 20 = 2 × 10
3. 8 × 100 = 800
4. 7 × 1,000 = 7,000

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LESSON 6
Review Exploring Patterns in Multiplication

Lesson Overview

In this lesson, students extend their understanding of patterns in multiplication, developed when they multiplied single-digit numbers by 10, 100 and 1,000. They apply this knowledge to find the products of single-digit numbers and multiples of 10, 100, and 1,000.

Lesson Essential Questions

- How can understanding properties and patterns in multiplication help us to solve problems more efficiently?
- How does understanding place value help me to solve multiplication problems?

Learning Objectives

In this lesson

- Students will apply place value concepts to multiply by multiples of 10, 100, and 1,000.
- Students will explain patterns when multiplying by multiples of 10, 100, and 1,000.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

multiples

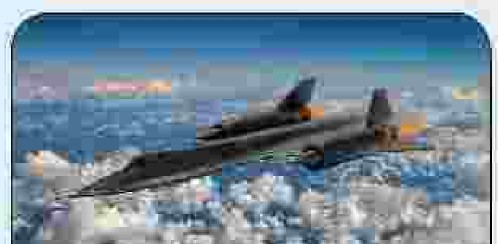
Materials List

- 9 Spinner (1 per small group)
- Paperclip (1 per group)
- Scissors (1 per group)

Preparation

Photocopy the Blackline Master at the end of this volume.

DIGITAL



Lesson 6
Review Exploring Patterns in Multiplication

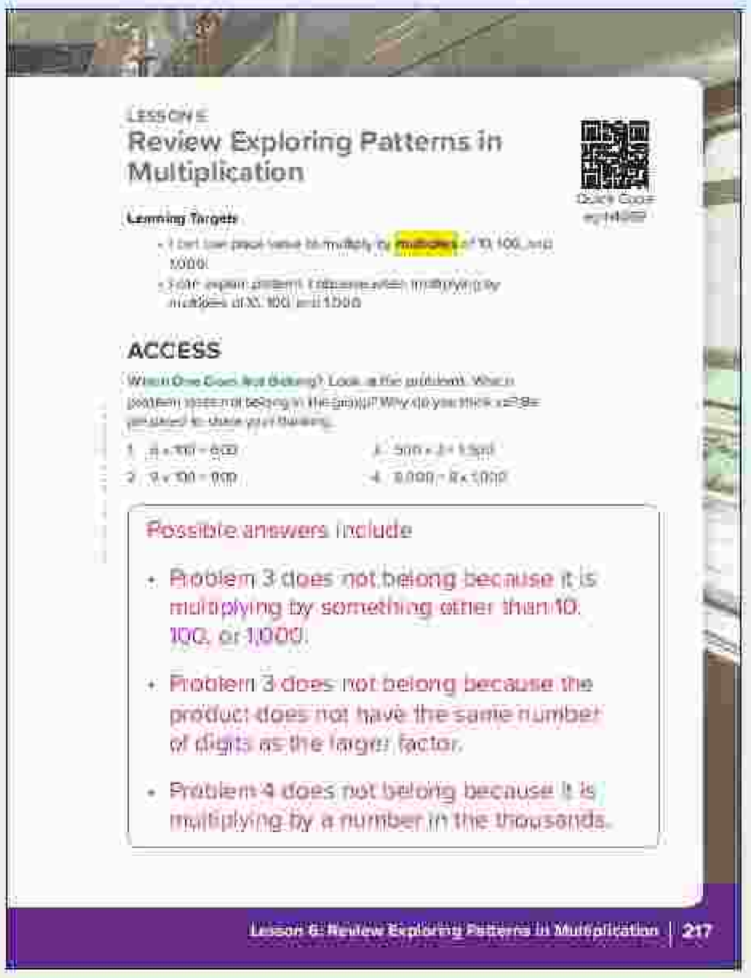
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LESSON 6

Review Exploring Patterns in Multiplication

Quick Code

Learning Targets

- [illegible]
- [illegible]

ACCESS

[illegible]

Possible answers include

- Problem 3 does not belong because it is multiplying by something other than 10, 100, or 1,000.
- Problem 3 does not belong because the product does not have the same number of digits as the larger factor.
- Problem 4 does not belong because it is multiplying by a number in the thousands.

Lesson 6: Review Exploring Patterns in Multiplication | 217

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may get confused with how many 0s to place at the end of a product. For example, students may write $6 \times 30 = 1{,}800$ instead of $6 \times 30 = 180$.
- Students may get confused when multiplying by a factor with 5 as the leading digit since the product may end in a 0 already. As a result, they may place the incorrect number of zeros to their answer. For example, when multiplying 5×400, students may write $5 \times 400 = 200$.

Which One Does Not Belong?

1. Direct students to Lesson 6 ACCESS Which One Does Not Belong? Ask students to look at the four problems and decide which problem does not belong in the group.
2. When students are ready, ask volunteers to share their answers and reasoning with the class. Encourage students to use mathematical terminology to support their explanations.

   Possible answers include

   - Problem 3 does not belong because it is multiplying by something other than 10, 100, or 1,000.
   - Problem 3 does not belong because the product does not have the same number of digits as the larger factor.
   - Problem 4 does not belong because it is multiplying by a number in the thousands.
3. Explain to students that they will continue to apply what they have learned about place value, multiplication, and patterns to solve problems.

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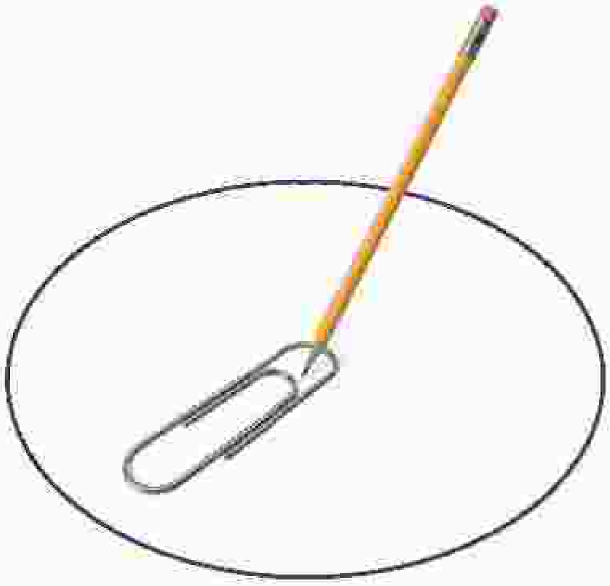
BUILD (40 min)

Connect and Extend (10 min)

1. Direct students to Lesson 6 BUILD Connect and Extend. Ask students what they notice about the problem. How is it different from or the same as problems they have seen before?
2. Ask students to share their thinking with their Shoulder Partner and discuss what strategy they would use to solve the problem. (Possible strategies include skip counting, using a place value chart, or recognizing that they can use the multiplication fact 7 × 3 and add two zeroes.)
3. Ask students to share their thinking with the whole group. If no students mention the strategy of using multiplication facts, explain it along with the pattern of zeroes in the factor 700 and product 2,100.

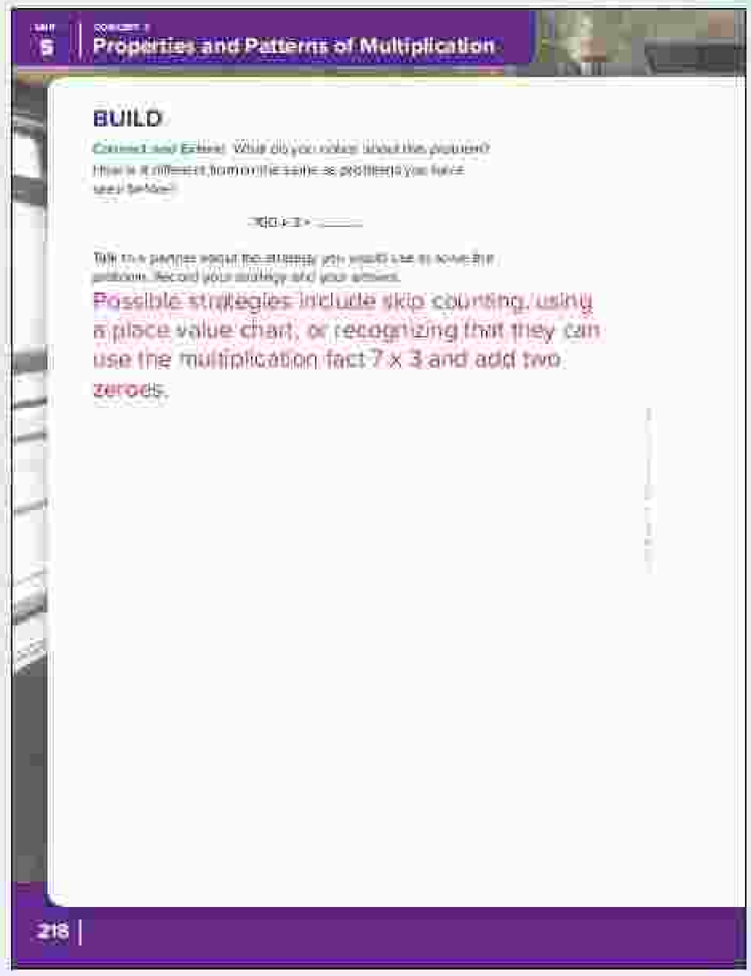
Spinning for Factors (30 min)

1. Divide students into small groups. Distribute a 9-Spinner and paper clip to each group. Explain to students how to use the spinner: place the paper clip at the center point of the spinner, place the point of a pencil inside the paper clip at center point of the spinner, and flick the paper clip to make it spin around the pencil point.



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UNIT 5 | CONCEPT 2
Properties and Patterns of Multiplication

BUILD

Connect and Extend What do you notice about the problem? How is it different from or the same as problems you have seen before?

700 × 3 = ______

Talk to a partner about the strategy you would use to solve the problem. Record your strategy and your answer.

Possible strategies include skip counting, using a place value chart, or recognizing that they can use the multiplication fact 7 × 3 and add two zeroes.

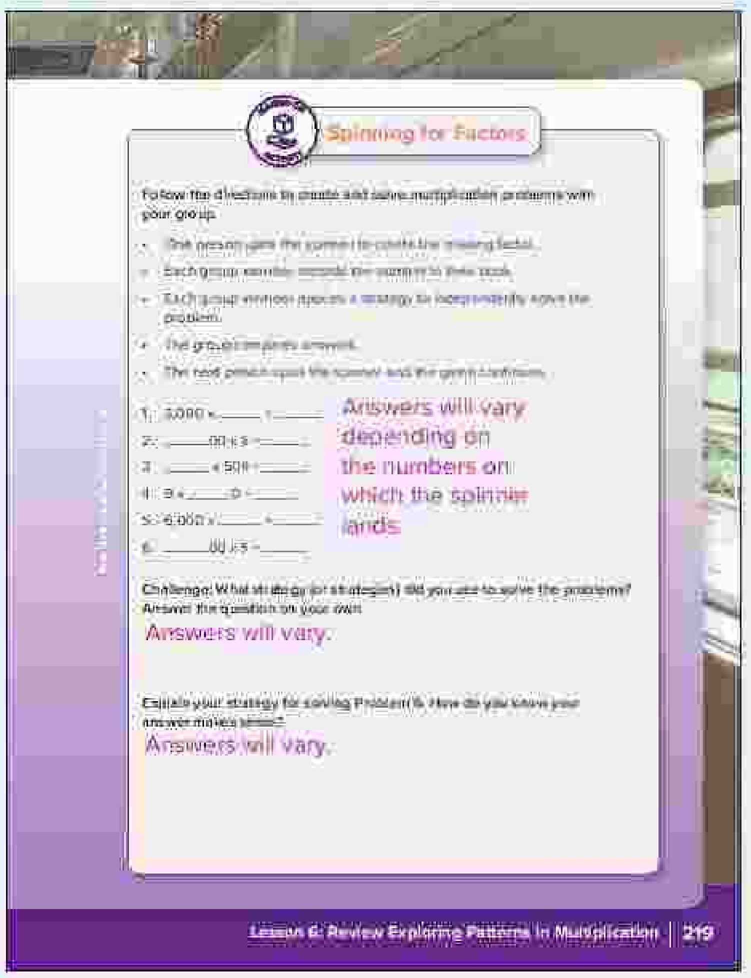
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Spinning for Factors

Follow the directions to create and solve multiplication problems with your group.

- One person spins the spinner to create the missing factor.
- Each group member records the number in their book.
- Each group member applies a strategy to independently solve the problem.
- The group compares answers.
- The next person spins the spinner and the game continues.

1. 3,000 × ______ = ______
2. ______00 × 5 = ______
3. ______ × 500 = ______
4. 9 × ______0 = ______
5. 6,000 × ______ = ______
6. ______00 × 5 = ______

Answers will vary depending on the numbers on which the spinner lands.

Challenge: What strategy (or strategies) did you use to solve the problems? Answer the question on your own.

Answers will vary.

Explain your strategy for solving Problem 6. How do you know your answer makes sense?

Answers will vary.

Lesson 6: Review Exploring Patterns in Multiplication | 219

2. Direct students to Lesson 6 BUILD Spinning for Factors. Explain to students that they will use the spinner to create multiplication problems. For example, one student spins the spinner and all group members record the number in their books. Then, all group members apply a strategy to independently solve the problem and then compare their answers with the group.
3. Give students time to play the game. Students who finish early should answer the Challenge question.
4. As students play, walk around, and monitor their work. Ask groups to share some of their equations and answers with you. Take note of any errors being made by multiple students so you can address them. Offer support as needed.
5. After about 20 minutes, stop students and direct their attention to Problem 6.
6. Ask each group to share the number they spun for Problem 6 and the product they found. Record each group's equation on the board as follows:
    - Write the equations for which students spun an **even** number in one column.
    - Write the equations for which students spun an **odd** number in a second column.
7. Ask students to compare the products of the even-spin equations and the odd-spin equations.
8. Ask questions to help students recognize that, when the spun factor is even, there is always an extra 0 in the product. For example, 200 × 5 = 1,000. 200 has two zeroes, but 1,000 has three. However, 300 × 5 = 1,500. 300 and 1,500 have two zeroes.

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CONNECT (7 min)

Writing About Math

1. Ask students to turn to Lesson 6 CONNECT Writing About Math. Direct students' attention to the images of Usain Bolt and the Blackbird aircraft. Explain that Usain Bolt is the fastest man in the world and the Blackbird is the fastest plane in the world.
2. Ask students to work independently to respond to the Writing About Math prompt.

WRAP-UP

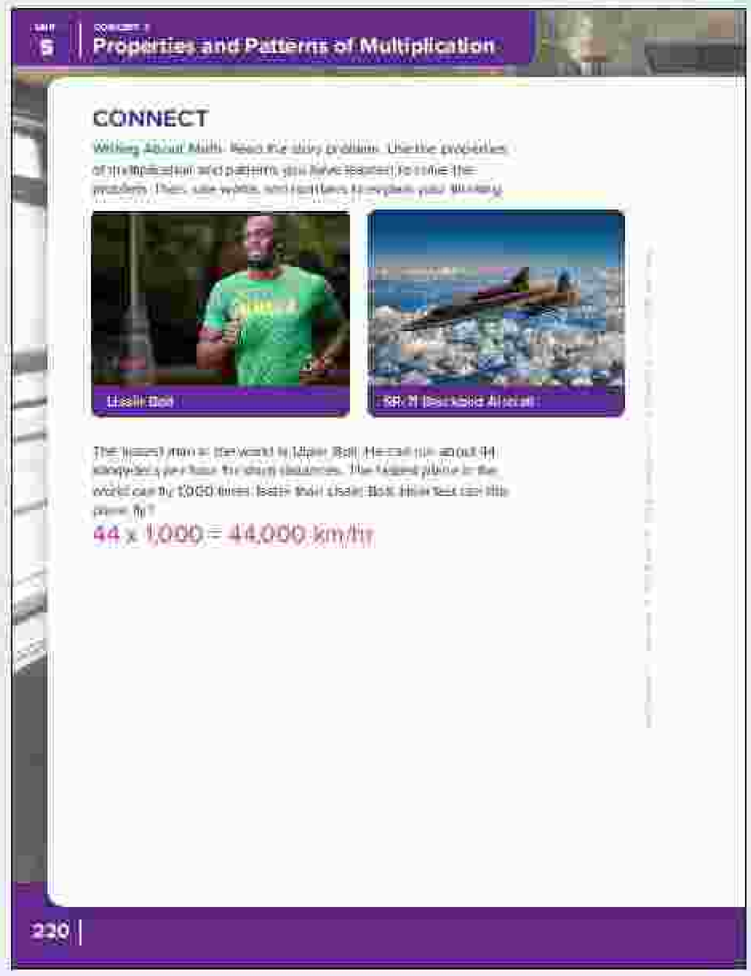
Let's Chat About Our Learning (3 min)

1. Ask students to share their answers and explain their problem-solving strategies. If no students mention them, explain that students could use the Identity Property of Multiplication and patterns for multiplying by 1,000.

Answer Key: $44 \times 1{,}000 = 44{,}000$

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UNIT 5 | CONCEPT 2
Properties and Patterns of Multiplication

CONNECT

Writing About Math: Read the story problem. Use the properties of multiplication and patterns you have learned to solve the problem. Then, use words and numbers to explain your thinking.

Usain Bolt

SR-71 Blackbird Aircraft

The fastest man in the world is Usain Bolt. He can run about 44 kilometers per hour for short distances. The fastest plane in the world can fly 1,000 times faster than Usain Bolt. How fast can this plane fly?

44 x 1,000 = 44,000 km/hr

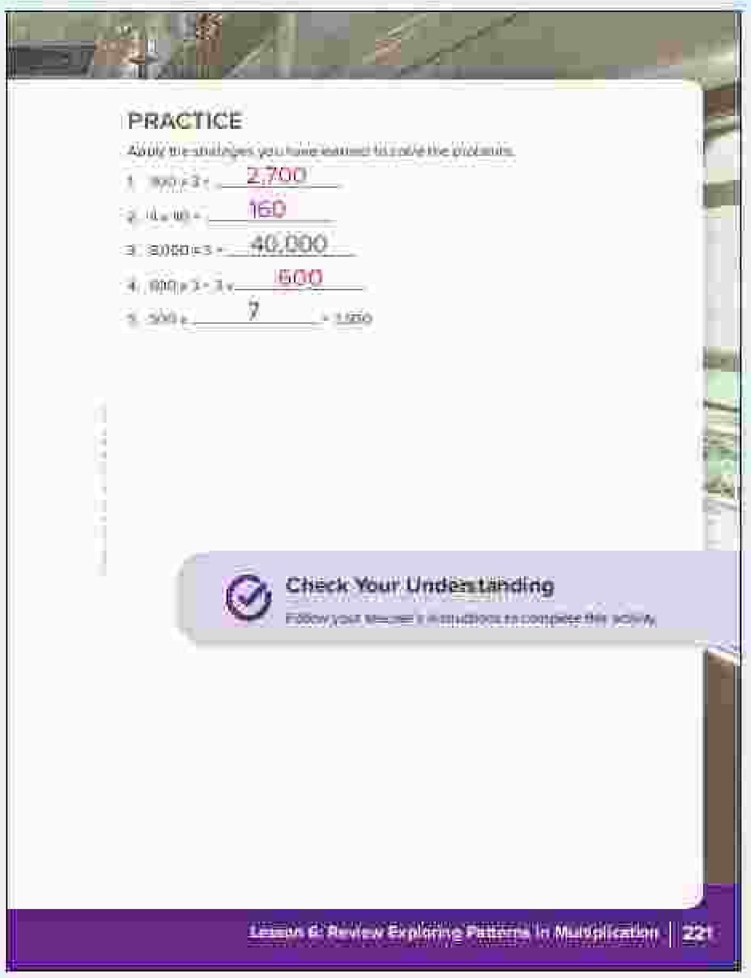
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PRACTICE

Apply the strategies you have learned to solve the problems.

1. 900 × 3 = 2,700
2. 4 × 40 = 160
3. 8,000 × 5 = 40,000
4. 100 × 2 × 3 = 600
5. 500 × 7 = 3,500

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 6: Review Exploring Patterns in Multiplication | 221

PRACTICE

Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Apply the strategies you have learned to solve the problems.

1. 80 × 6 = 480
2. 12,000 = 4,000 × 3
3. 200 × 9 = 1,800
4. 5 × 400 = 2,000

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LESSON 7
Exploring More Patterns in Multiplication

Lesson Overview

In this lesson, students explore the Associative Property of Multiplication and compare it to the Commutative Property of Multiplication. Students build understanding that changing the grouping of factors in a multiplication problem with three factors does not change the product. Students are introduced to parentheses in computation and solve multiplication problems involving parentheses.

Lesson Essential Questions

- How can understanding properties and patterns in multiplication help us to solve problems more efficiently?
- How does understanding place value help me to solve multiplication problems?

Learning Objectives

In this lesson

- Students will explain the Associative Property of Multiplication.
- Students will apply the Associative Property of Multiplication to solve problems.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

Associative Property of Multiplication, Commutative Property of Multiplication, parentheses

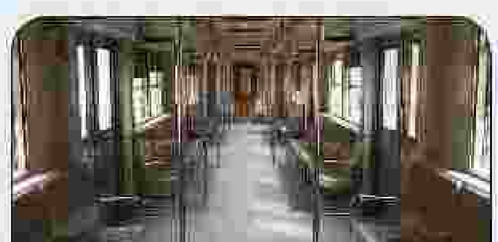
Materials List

- No additional materials needed

Preparation

- No advance preparation needed

DIGITAL



Lesson 7

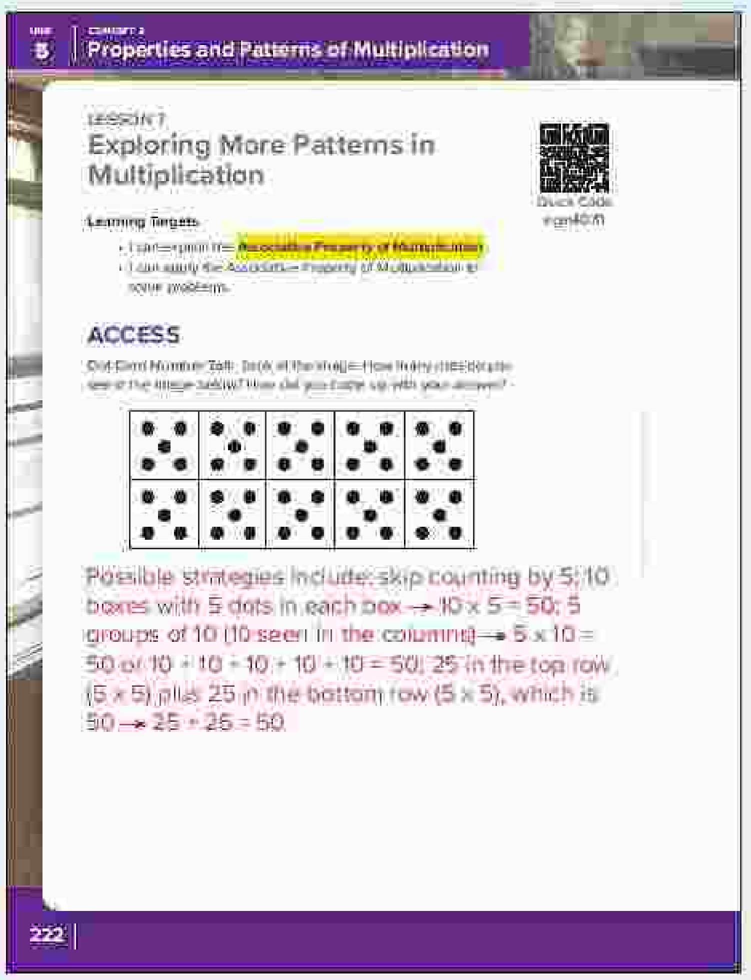
Exploring More Patterns in Multiplication

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UNIT 5 | CONCEPT 2 **Properties and Patterns of Multiplication**

LESSON 7

Exploring More Patterns in Multiplication

Quick Code

Learning Targets

- I can explain the Associative Property of Multiplication.
- I can apply the Associative Property of Multiplication to solve problems.

ACCESS

Dot Card Number Talk: Look at the image. How many dots do you see in the image below? How did you come up with your answer?

Possible strategies include: skip counting by 5; 10 boxes with 5 dots in each box → 10 × 5 = 50; 5 groups of 10 (10 seen in the columns) → 5 × 10 = 50 or 10 + 10 + 10 + 10 + 10 = 50; 25 in the top row (5 × 5) plus 25 in the bottom row (5 × 5), which is 50 → 25 + 25 = 50.

222

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have trouble strategically identifying two factors to multiply first in a problem and always attempt to multiply the factors in the order they are presented making the problem more difficult to solve.

Dot Card Number Talk

1. Direct students to Lesson 7 ACCESS Dot Card Number Talk. Give students about 15 seconds, and then ask them to give a Thumbs Up if they know how many dots are in the image.
2. Ask students to share their strategies and record their problem-solving processes on the board using numbers, words, and pictures. At this time, honor all answers and do not inform students as to whether or not their responses are accurate. As students share their thinking, other students can give a Thumbs Up if they agree. Allow students to question and critique each other's strategies.

   Possible strategies include

   - Skip counting by 5
   - 10 boxes with 5 dots in each box ⟶ 10 × 5 = 50
   - 5 groups of 10 (10 seen in the columns) ⟶ 5 × 10 = 50 or 10 + 10 + 10 + 10 + 10 = 50
   - 25 in the top row (5 × 5) plus 25 in the bottom row (5 × 5) which is 50 ⟶ 25 + 25 = 50
3. Encourage students to identify similarities and differences between strategies and to make connections to previous lessons. If no students mention the Commutative Property of Multiplication or patterns when multiplying by 10, help students to make connections by writing 5 × 10 = 10 × 5 on the board. If necessary, use this to review the content from previous lessons on multiplying by 10.

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BUILD (40 min)

Uncovering the Associative Property of Multiplication (20 min)

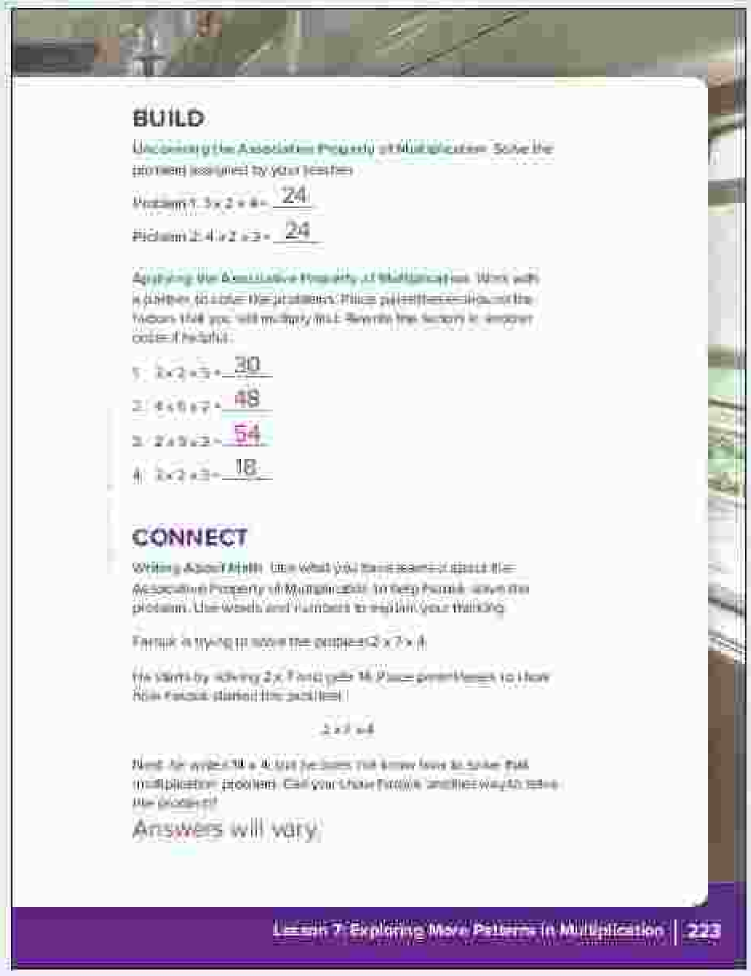
1. Ask students to turn to Lesson 7 BUILD Uncovering the Associative Property of Multiplication.
2. Divide the class in half. Ask one-half of the students to solve Problem 1. Ask the other half to solve Problem 2.
3. Write 3 × 2 × 4 on the board and ask a student from that group to share the product. Ask group members to confirm that they got the same answer.
4. Repeat the process with 4 × 2 × 3.
5. With both problems and products written on the board, ask students to share what they Notice and Wonder about the problems they see on the board.

   Possible student responses

   - (Notice) Both multiplication problems are equal to 24.
   - (Notice) The problems have the same factors in them.
   - (Notice) The order of the factors in each problem is different.
   - (Wonder) Can you always change the order of the factors in a multiplication problem and still get the same product?
6. If students do not share the Wonder question, pose the question to students as something you are wondering. Tell students they have just uncovered a multiplication property called the Associative Property of Multiplication.
7. Ask students to recall the other multiplication properties they have learned (Commutative, Identity, Zero). If necessary, provide hints to help students remember.
8. Tell students that the Associative Property of Multiplication allows us to group the factors in a multiplication problem in any order and still get the same product.

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BUILD

24

24

30

48

54

18

CONNECT

Answers will vary.

Lesson 7: Exploring More Patterns in Multiplication | 223



Applying the Associative Property of Multiplication (20 min)

1. Write the problem 8 × 2 × 3 = _______ on the board.
2. Ask a student to restate the Associative Property of Multiplication. If necessary, remind students that the property tells us when we have three or more factors in a multiplication problem, we can multiply any two factors first.
3. Do a Think Aloud to model a problem-solving strategy. The following is a suggested process:
   - First, I will try to solve the problem in the order that the factors are written.
   - I can put parentheses around the part of the problem I will solve first.
     - Write parentheses around the 8 × 2 so that the problem reads (8 × 2) × 3.
   - I know that 8 × 2 = 16. But what is 16 × 3?
     - Write 8 × 2 = 16. 16 × 3 = ?
   - Since 16 × 3 is not a basic multiplication fact, I am going to try something different.
   - I know that that because of the Associative Property of Multiplication, I can multiply any two factors together first and get the same answer. So I am going to multiply 2 × 3 first. I will put parentheses around 2 × 3 because I am going to solve that part first.
     - Write 8 × (2 × 3) = _______
   - I know that 2 × 3 = 6.
     - Write 2 × 3 = 6.
   - Now I just need to multiply 6 × 8.
     - Write 6 × 8 = 48.
     - Add the answer to the equation so it reads 8 × (2 × 3) = 48.
4. Ask students what questions they have about the problem-solving process you just modeled. Clear up misconceptions before moving on.
5. Direct students to Lesson 7 BUILD Applying the Associative Property of Multiplication and go over the directions with students. Ask students to work with a partner to use what they know about the Associative Property to solve the problems.
6. At the end of BUILD, go over the answers with students. Ask students to share the different ways they arranged the factors.

Answer Key for Applying the Associative Property of Multiplication:

1. 3 x 2 x 5 = _______ 30
2. 4 x 6 x 2 = _______ 48
3. 2 x 9 x 3 = _______ 54
4. 3 x 2 x 3 = _______ 18

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 7 CONNECT Writing About Math and read the directions aloud. Ask students to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask students to share their solutions to the Writing About Math problem and explain their thinking.
2. Ask students to explain how they used the Associative Property of Multiplication to solve the problem.

PRACTICE

Direct students to Lesson 7 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve each problem. Multiply the part in the parentheses first. Show your work.

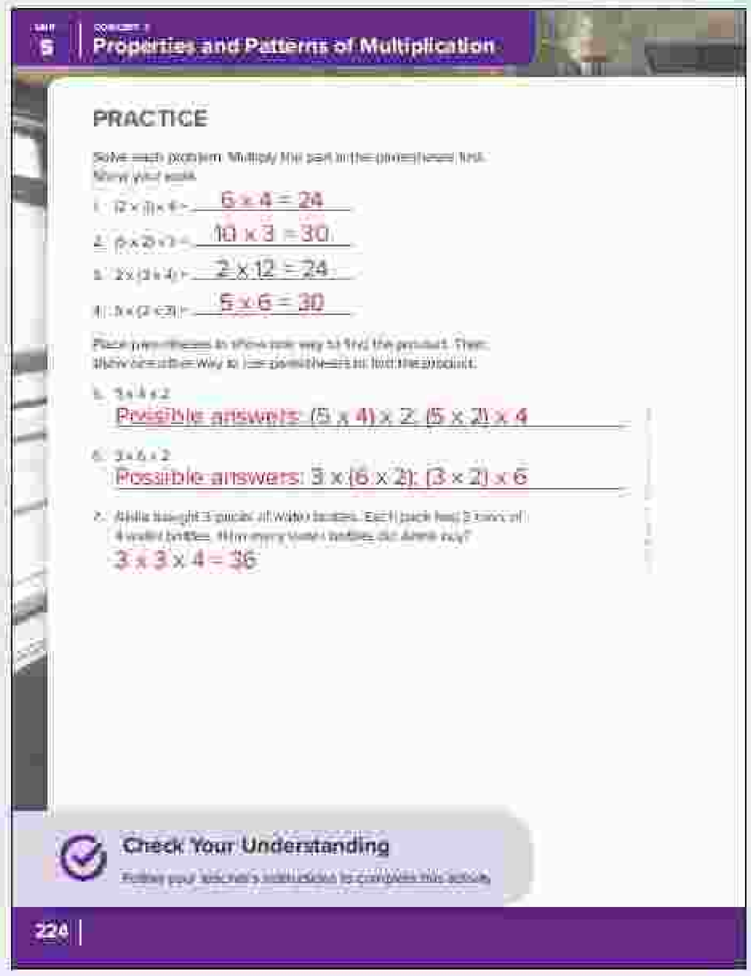
1. $(3 \times 2) \times 7 =$ $6 \times 7 = 42$
2. $7 \times (2 \times 5) =$ $7 \times 10 = 70$

Solve each problem. Place parentheses to indicate how you grouped the factors. Show your work.

3. $5 \times 3 \times 4 =$ 60
   Possible answers: $(5 \times 3) \times 4$; $5 \times (3 \times 4)$; $(5 \times 4) \times 3$
4. $8 \times 2 \times 4 =$ 64
   Possible answers: $(8 \times 2) \times 4$; $8 \times (2 \times 4)$; $(8 \times 4) \times 2$

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LESSON 8
Applying Patterns in Multiplication

Lesson Overview

In this lesson, students write a multiple of 10, 100, or 1,000 as ___ × 10, ___ × 100, or ___ × 1,000. They then use the Associative Property of Multiplication to show another way to solve problems with a one-digit number and a multiple of 10, 100, or 1,000.

Lesson Essential Questions

- How can understanding properties and patterns in multiplication help us to solve problems more efficiently?
- How does understanding place value help me to solve multiplication problems?

Learning Objective

In this lesson

- Students will apply decomposing and the Associative Property of Multiplication to solve equations with multiples of 10, 100, or 1,000.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

decompose, factors, multiples

Materials List

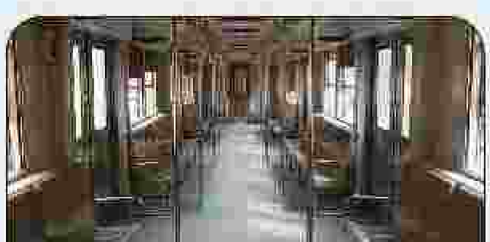
- Digit cards 0–9 (optional)

Preparation

No additional materials needed

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Lesson 8

Applying Patterns in Multiplication

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

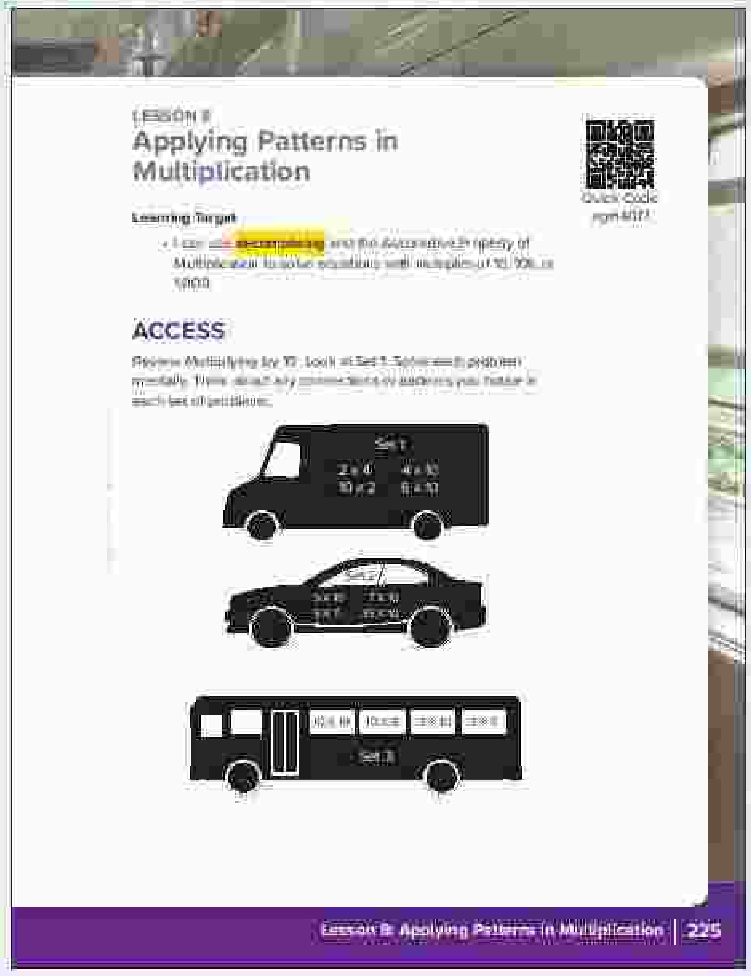
- Students may factor the multiple of ten into a factor pair that is less efficient to use when applying the Associative Property of Multiplication. This is not actually an error in computation. For example, thinking of 300 as 3 × 100 is helpful in solving these problems while thinking of 300 as 5 × 60 is correct but less efficient in this lesson.
- Students may have difficulty applying the properties and patterns they learned in previous lessons to multiplying a two-digit number by 10, 100, or 1,000. When multiplying 27 × 100, students should recognize 27 × 1 = 27 and place two zeroes in the product.

Review Multiplying by 10

1. Direct students to Lesson 8 ACCESS Review Multiplying by 10. Present students with problem Set 1. Tell students to solve these problems mentally.
2. Ask students to reflect on any connections or patterns they notice in the problems in Set 1.
3. Use Calling Sticks to select students to share their thinking. Record students' thinking on the board to make it visible for all students.
4. Repeat the process with Sets 2 and 3. Encourage students to draw conclusions about the patterns they will observe when they multiply numbers by 10.

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LESSON 8

Applying Patterns in Multiplication

Learning Target

- I can use decomposing and the Associative Property of Multiplication to solve equations with multiples of 10, 100, or 1000.

ACCESS

Review Multiplying by 10. Look at Set 1. Solve each problem mentally. Think about any connections or patterns you notice in each set of problems.

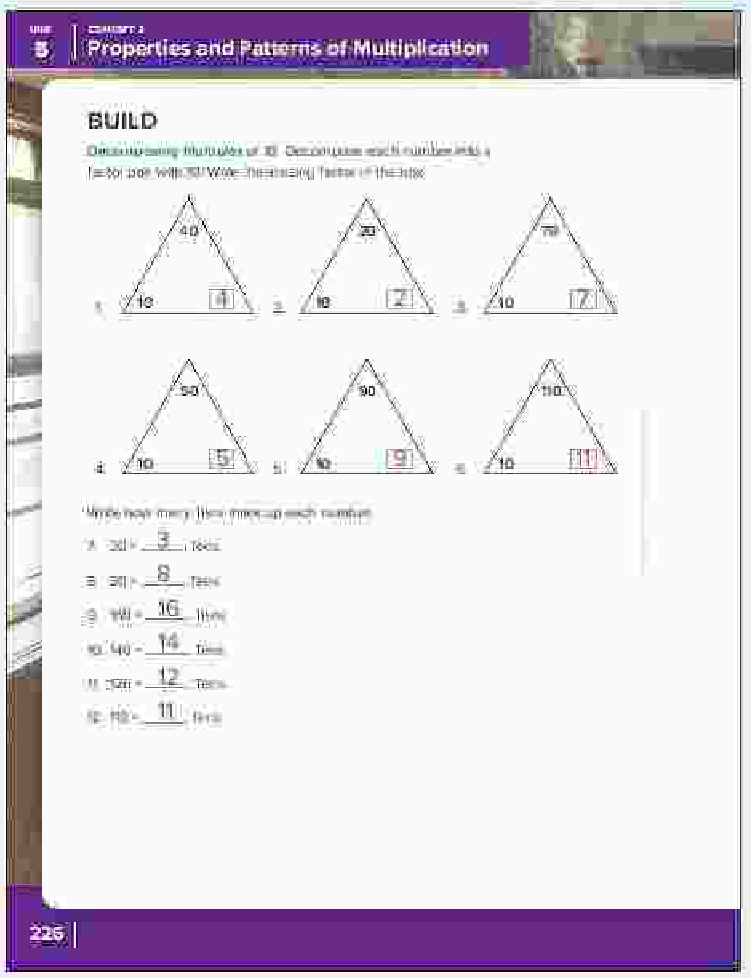
Lesson 8: Applying Patterns in Multiplication | 225

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UNIT 5 | CONCEPT 2
Properties and Patterns of Multiplication

BUILD

Decomposing Multiples of 10: Decompose each number into a factor pair with 10. Write the missing factor in the box.

1. 40: 10, 4
2. 20: 10, 2
3. 70: 10, 7
4. 50: 10, 5
5. 90: 10, 9
6. 110: 10, 11

Write how many Tens make up each number.

7. 30 = 3 Tens
8. 80 = 8 Tens
9. 160 = 16 Tens
10. 140 = 14 Tens
11. 120 = 12 Tens
12. 110 = 11 Tens

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BUILD (40 min)

Decomposing Multiples of 10 (10 min)

1. Direct students to Lesson 8 BUILD Decomposing Multiples of 10.
2. Ask students to work with a partner to solve Problems 1–6.

   TEACHER NOTE: Students have done a great deal of work with factor triangles in previous grades. However, if they struggle to solve the problems, work with the whole group to until they are able to work on their own or with a partner.

3. After a few minutes, go over the answers together.

   Answer Key for Decomposing Multiples of 10 (1–6):
   1. 4 2. 2 3. 7 4. 5 5. 9 6. 11

4. Explain to students that they just decomposed these numbers into factors. Remind students that knowing how to decompose a number is especially helpful when working with larger numbers.
5. Tell students that this time they will write the number of Tens in each number. Model the first problem for the students, if needed. Ask students to work with a partner to solve problems 7–12.

   Answer Key for Decomposing Multiples of 10 (7–12):
   7. 3 8. 8 9. 16 10. 14 11. 12
   12. 11

Multiplying by Multiples of 10, 100, and 1,000 (30 min)

1. Direct students to Lesson 8 BUILD Multiplying by Multiples of 10. Share with students that today they will be applying the Associative Property of Multiplication and decomposing multiples of 10, 100, and 1,000.
2. Do a Think Aloud to model a problem-solving strategy for the Example problem. A suggested process follows:
   - Let's look at the example problem 7 × 20.
     - Write 7 × 20 = _______ on the board.

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- In this problem we have a 1-digit number (7) being multiplied by a multiple of 10 (20).
- One way to solve this problem is to use what we know about decomposing and the Associative Property of Multiplication.
- I know that 20 is the same as 2 × 10, so I am going to decompose 20 into 2 × 10. Those are easy numbers to multiply.
  - Decompose 20 on the board as follows.
    - 7 × 20 = _______

      2 10

      7 × 2 × 10 = _______
- The Associative Property of Multiplication tells me that I can group these factors any way I want to. I am going to multiply 7 × 2 first because they are not multiples of 10.
  - Draw parentheses around 7 × 2.
- 7 × 2 equals 14, so I will write that under the problem.
  - Write the equivalent expression 14 × 10 below the problem.
- I remember in previous lessons that when we multiplied a number by 10, we used the Identity Property of Multiplication and discovered a pattern in the number of zeroes in the factor and the product. I know that 14 is going to stay 14, but because I am multiplying by 10 I need to add a 0.
  - Write 14 × 10 = 140 on the board.

TEACHER NOTE: Students may be able to solve 7 × 20 using the strategies taught in previous lessons. However, remind students that we often look at problems in different ways because it is important to have a "toolkit" of problem-solving strategies, especially when we solve more challenging problems. Students will select the strategy they prefer at the end of the lesson.

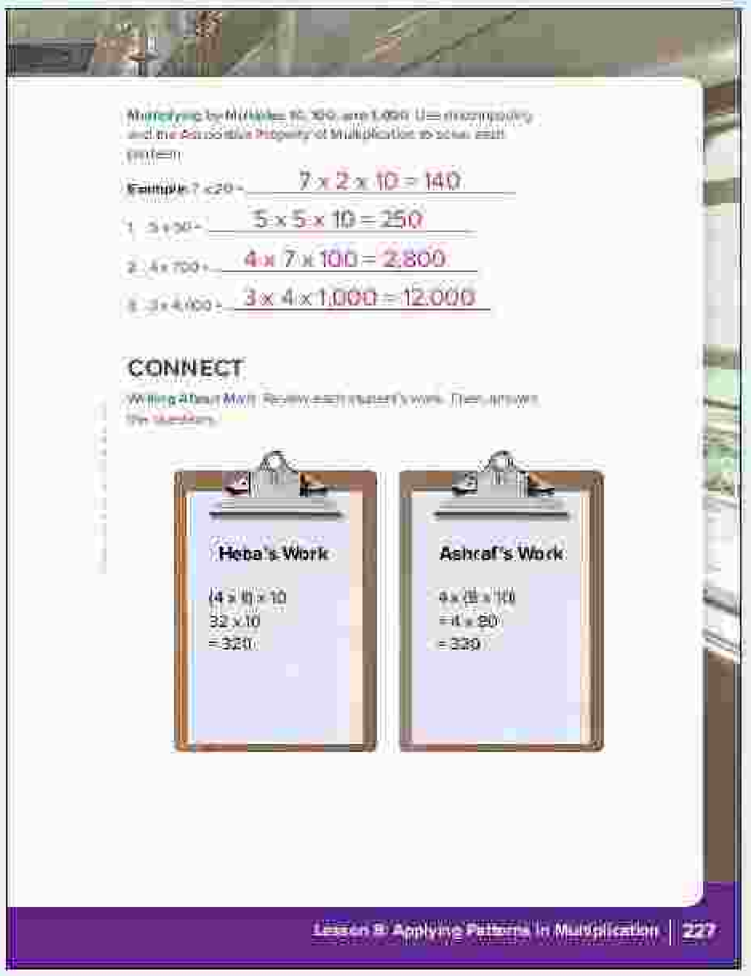
3. Ask students to help you solve Problem 1. Encourage students to tell you what problem-solving steps to take and to explain their reasoning. Show the work on the board. If necessary, ask questions to spur thinking, such as:
   - *How can we decompose 50 into a factor pair?*
   - *How can we rewrite the equation with the new factor pair?*
   - *Where should we put the parentheses?*
   - *What is the answer to the problem?* 250
4. If students are ready, have them work with a partner to solve Problems 3 and 4. Alternatively, have some students work with a partner while you work with students who need additional instruction and support.
5. With about 5 minutes left in BUILD, go over the answers with students.

Answer Key for Multiplying by Multiples of 10, 100, and 1000:
2. 4 × 700 = 2,800
3. 3 × 4,000 = 12,000



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Multiplying by Multiples 10, 100, and 1,000 Use decomposing and the Associative Property of Multiplication to solve each problem.

Example 7 × 20 = 7 × 2 × 10 = 140

1. 5 × 50 = 5 × 5 × 10 = 250

2. 4 × 700 = 4 × 7 × 100 = 2,800

3. 3 × 4,000 = 3 × 4 × 1,000 = 12,000

CONNECT

Writing About Math Review each student's work. Then answer the questions.

Heba's Work

(4 × 8) × 10
32 × 10
= 320

Ashraf's Work

4 × (8 × 10)
= 4 × 80
= 320

Lesson 8: Applying Patterns in Multiplication | 227

CONNECT (7 min)

Writing About Math

Direct students to Lesson 8 CONNECT Writing About Math and ask them to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share with the group which strategy they preferred in the CONNECT problem and explain why.

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PRACTICE

Direct students to Lesson 8 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Decompose each multiple of 10 before solving.

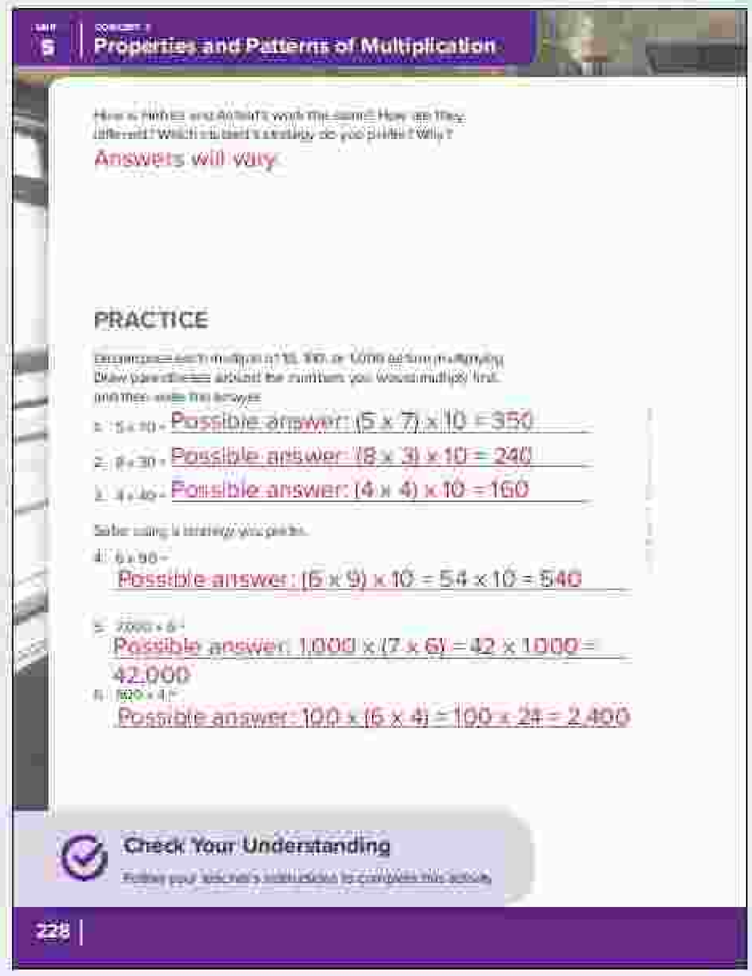
1. 7 × 40 7 × 4 × 10 = 280
2. 5 × 90 5 × 9 × 10 = 450

Solve using the strategy you prefer.

3. 80 × 5 = 400
4. 4 × 900 = 3,600

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UNIT 5 | Properties and Patterns of Multiplication

Answers will vary.

PRACTICE

1. Possible answer: (5 x 7) x 10 = 350
2. Possible answer: (8 x 3) x 10 = 240
3. Possible answer: (4 x 4) x 10 = 160
4. Possible answer: (6 x 9) x 10 = 54 x 10 = 540
5. Possible answer: 1,000 x (7 x 6) = 42 x 1,000 = 42,000
6. Possible answer: 100 x (6 x 4) = 100 x 24 = 2,400

Check Your Understanding

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Materials List

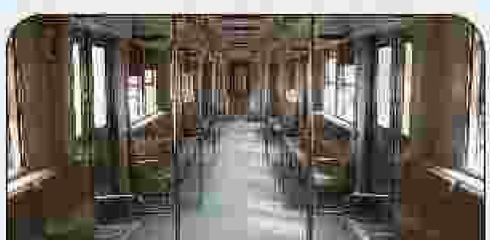
- Materials will vary

Preparation

- Materials will vary

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DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4072

Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Properties and Patterns of Multiplication. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- Do the properties of addition not apply to subtraction? Why or why not?
- How many ways can I add and subtract?
  - Which way is the most efficient?
- How can estimation help me be accurate?
- How many different ways can I add?
  - Which way is the most efficient?
- How many different ways can I subtract?
  - Which way is the most efficient?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to properties and patterns of multiplication.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

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Vocabulary Check-In

Review concept vocabulary as needed

COMMON MISCONCEPTIONS AND ERRORS

- Students may get confused with how many 0s to place at the end of a product. For example, students may write 6 × 10 = 600 instead of 6 × 10 = 60.
- Students may get confused when multiplying by a factor with 5 as the leading digit since the product may end in a 0 already. As a result, they may place the incorrect number of zeros to their answer. For example, when multiplying 5 × 400, students may write 5 × 400 = 200.
- Students may have trouble strategically identifying two factors to multiply first in a problem and always attempt to multiply the factors in the order they are presented making the problem more difficult to solve.
- Students may have difficulty applying the properties and patterns they learned in previous lessons to multiplying a two-digit number by 10, 100, or 1,000.

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Remediation: Correcting Misconceptions

If…	**Then…**
Students are struggling to solve problems using the patterns of multiples of 10…	Review Place Value Patterns from Lesson 5 and Spinning for Factors from Lesson 6. Consider using Tens rods to help students make concrete connections between skip counting by 10 and multiplying by 10.
If…	**Then…**
Students have trouble multiplying 3 single-digit factors…	Review Applying the Associative Property of Multiplication from Lesson 7. Consider using counters to build arrays to support understanding of the concept (for example 3 arrays of 4 by 2).
If…	**Then…**
Students struggle to think strategically when grouping factors when multiplying 3 digits…	Review Lesson 7. Consider having multiplication tables for students to refer to as they solve multiplication problems with three factors. Encourage students to look for numeric relationships that will help them group factors in a way that makes problems easier to solve. Review friendly multiplication numbers, such as 2, 5, and 10, and patterns they have observed when multiplying by multiples of 10.

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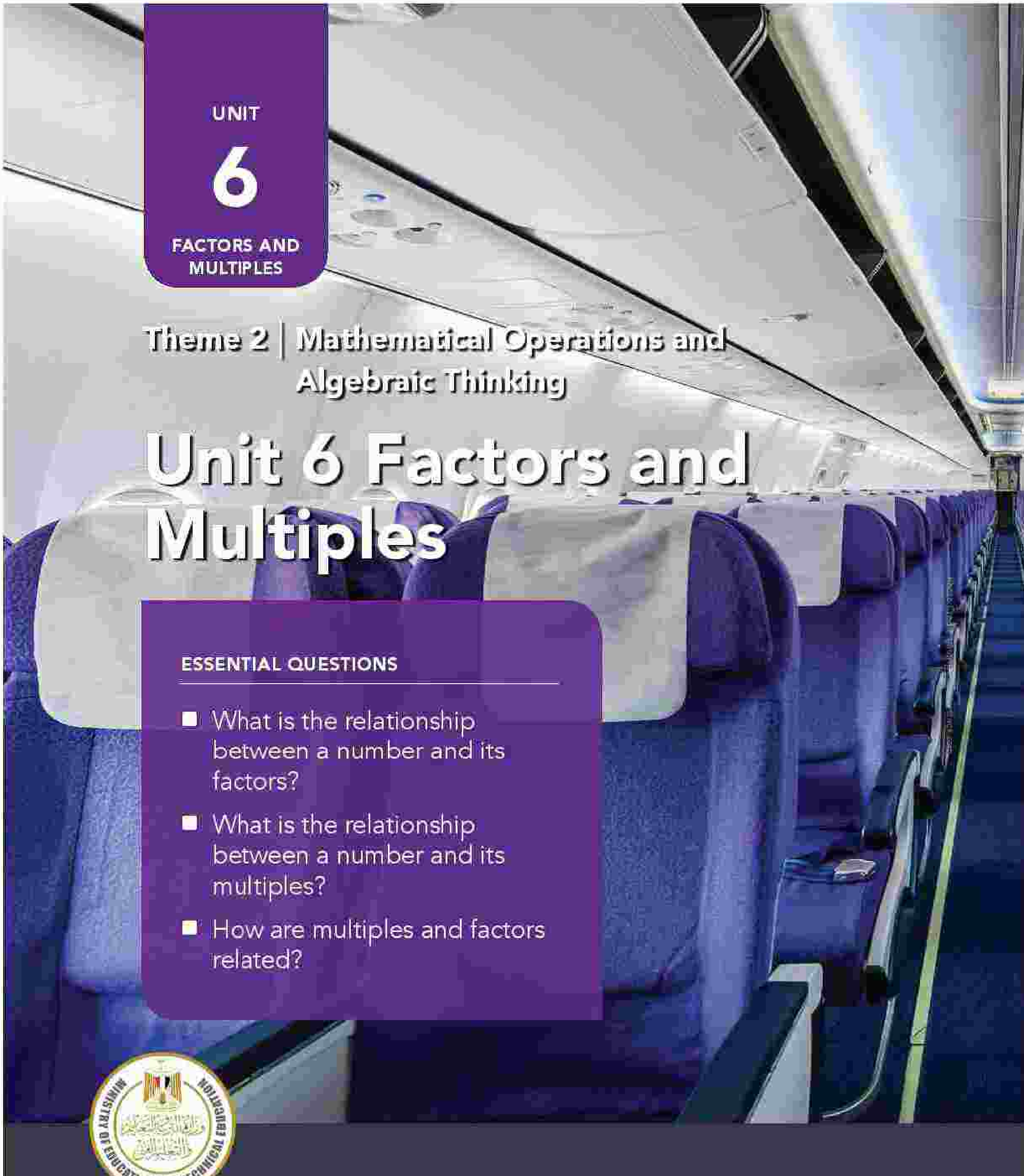
UNIT

6

FACTORS AND MULTIPLES

Theme 2 | Mathematical Operations and Algebraic Thinking

Unit 6 Factors and Multiples



ESSENTIAL QUESTIONS

- What is the relationship between a number and its factors?
- What is the relationship between a number and its multiples?
- How are multiples and factors related?



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Video Questions

The Unit 6 Opener Video, Freeway Factors, describes different ways to group passengers in cars using multiplication. Omar and Mariam are helping their teacher plan a school trip. To determine which type of transportation the school should use for the trip, they will use their understanding of multiplication facts. But they may need help assigning students to seats.

- What are the different ways seats can be arranged?
- How would you arrange the students in your class for a field trip?

Quick Code
egmt4073

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

common factor, common multiple, composite, factor, factor pairs, greatest common factors, multiples, product, skip count

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Unit Storyline

Unit 6 Factors and Multiples Storyline

The Factors and Multiples unit extends students' working knowledge of the relationship between multiplication and division to solve problems. Students apply these understandings to find the factors of numbers using a variety of tools and strategies. To support learning, students observe video footage and investigate problems related to different modes of transportation to enhance their understanding of factors and multiples.

Unit Standards

4.C.2	Gain familiarity with factors and multiples.
4.C.2.a	Demonstrate understanding that a whole number is a multiple of each of its factors.
4.C.2.a.i	Find all factor pairs for a whole number in the range 1–100.
4.C.2.b	Find common multiples between two numbers.
4.C.2.c	Find the greatest common factor between two whole numbers.

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Unit 6 Structure and Pacing

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.	
Concept 1: Understanding Factors	
Lesson 1	**Identifying Factors of Whole Numbers** **Learning Objectives** • Students will define factors of a whole number. • Students will find all factors of a given number between 0 and 100. • Students will explain patterns they observe in numbers that have 2, 5, or 10 as factors. **Student Learning Targets** • I can define factors of a whole number. • I can identify factors of a whole number. • I can explain patterns I observe in numbers that have 2, 5, or 10 as a factor.
Lesson 2	**Prime and Composite Numbers** **Learning Objectives** • Students will find all factors of a given number between 0 and 100. • Students will explain patterns they observe in numbers that have 3, 6, or 9 as factors. • Students will determine if a number is prime or composite. **Student Learning Targets** • I can identify factors of a whole number. • I can explain patterns I observe in numbers that have 3, 6, or 9 as factors. • I can determine if a number is prime or composite.

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Unit Structure and Pacing *cont'd*

Lesson 3	**Greatest Common Factor** **Learning Objectives** • Students will find common factors between two whole numbers. • Students will identify the greatest common factor between two whole numbers. **Student Learning Targets** • I can find common factors between two whole numbers. • I can identify the greatest common factor between two whole numbers.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to identifying factors of whole numbers. **Student Learning Target** • I can correct my misconceptions and errors related to finding all of the factors of a number.

Concept 2: Understanding Multiples	
Lesson 4	**Identifying Multiples of Whole Numbers** **Learning Objectives** • Students will define multiples of whole numbers. • Students will identify multiples of whole numbers. **Student Learning Targets** • I can define multiples of whole numbers. • I can identify multiples of whole numbers.

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Lesson	Content
Lesson 5	**Common Multiples** **Learning Objective** • Students will identify common multiples between two numbers. **Student Learning Target** • I can identify common multiples of two numbers.
Lesson 6	**Relationships between Factors and Multiples** **Learning Objectives** • Students will explain the relationship between factors and multiples. • Students will determine if a number is a factor or a multiple of another number. **Student Learning Targets** • I can explain the relationship between factors and multiples. • I can determine if a number is a factor or a multiple of another number.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to finding multiples of whole numbers. **Student Learning Target** • I can correct my misconceptions and errors related to finding multiples of whole numbers.

Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:
Reduce ACCESS by 3 minutes
Reduce BUILD by 8 minutes
Reduce CONNECT by 2 minutes
Reduce WRAP-UP by 2 minutes
Strategies for reducing time in each section: • Discuss fewer examples • Eliminate Shoulder Partner conversations • Shorten class discussions • Work with students to complete ACCESS problems
If Mathematics instruction is based on a combination of 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:
Follow the 45-minute approach for the 45-minute days
Teach two 45-minute lessons on the 90-minute day
If Mathematics instruction is based on 90 minutes/5 days a week, do the following:
Increase ACCESS by 5 minutes
Increase BUILD by 20 minutes
Increase CONNECT by 3 minutes
Increase WRAP-UP by 2 minutes
Strategies for increasing time in each section: • Discuss additional examples as needed • Extend class discussions • Allow time for hands-on work with manipulatives and models • Provide additional practice problems for students who need additional practice • Encourage students to share and model their problem-solving strategies



Mathematical Background Knowledge

Understanding Factors and Multiples

In Primary 3, students worked to commit all multiplication facts to memory and used the relationship between multiplication and division to solve problems. In Primary 4, students use that knowledge to find the factors of a number. Students use a Hundreds chart to determine patterns for numbers that have factors of 2, 5, or 10 and develop an understanding that factors come in pairs. Students review the Identity Property of Multiplication and recall that one factor pair for every number is 1 and the number itself. Students are introduced to a factor rainbow and a T-chart as two methods to help them keep track of the factors of a number. This work builds the foundation for student's work with division later in Primary 4, where students divide with remainders and work on dividing larger numbers.

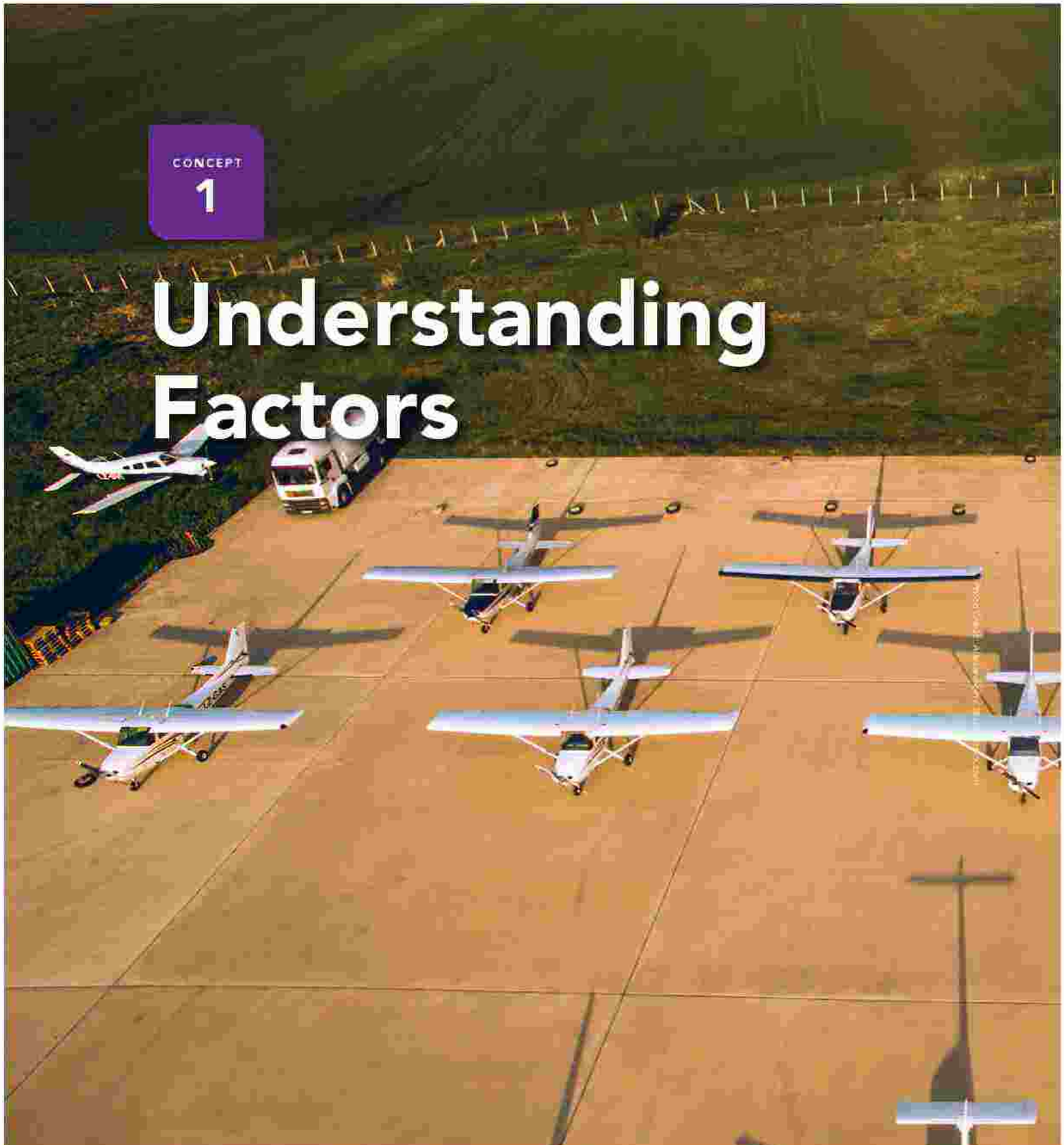
Students use their knowledge of multiplication facts and patterns they identified when skip counting by 2, 5, and 10 in the previous lesson to discover patterns for numbers that have factors of 3, 6, or 9. Armed with the knowledge of these quick rules for determining if a number has a factor of 2, 3, 5, 6, 9, or 10, students now have the ability to explore prime and composite numbers. Students extend their understanding of factors to find common factors and the greatest common factor of two numbers. These skills provide additional practice with math facts in preparation for multidigit multiplication and division in and for understanding equivalent fractions later in Primary 4. Students draw on this knowledge when developing an understanding of fraction equivalence.

In Concept 1, students learn about multiples and use skip counting on number lines and Hundreds charts as methods to identify multiples of a number. At the end of the Unit, students explore the relationship between factors and multiples. It is important for students to be familiar with finding multiples of a number when they begin multidigit division later in Primary 4. Identifying multiples also provides an additional opportunity to practice multiplication facts prior to Unit 7. Students extend their understanding of multiples as they work to identify common multiples between numbers. This is important as students begin to explore fractional relationships later in Primary 4. This is also important as students advance to Primary 5 where they continue to identify common multiples of numbers. In real life, common multiples are used to solve problems about frequency, amounts, and other everyday occurrences.

Just as multiplication and division are related operations, there is a similar relationship between factors and multiples. When factors are multiplied, the product is a multiple of the factors. In later units in Primary 4, students use factors and multiples as they work on multidigit multiplication and division. Understanding the relationship between factors and multiples will help students be more fluent with multiplication and division strategies such as area models, partial products, and standard algorithms. In Primary 5, students build automaticity in finding factors and multiples of numbers.

CONCEPT 1

Understanding Factors



Concept Overview

In Concept 1: Understanding Factors, students explore the concept of factors. They use their knowledge of multiplication facts, observation of patterns in skip counting, and number sense to build critical understanding of the relationship between numbers and their factors. They identify factors, common factors, and greatest common factors between two numbers. This work prepares them for working with larger numbers and fractions.



Concept Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a.i Find all factor pairs for a whole number in the range 1–100.

4.C.2.c Find the greatest common factor between two whole numbers.

Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Identifying Factors of Whole Numbers	• 24 tiles (1 set per student) (Photocopy the Lesson 1 24 Tiles Blackline Master at the end of this volume.) • Hundreds chart (1 per student) (Photocopy the Lesson 1 Hundreds Chart Blackline Master at the end of this volume.) • Crayons	Factor Factor pairs	• Students will define factors of a whole number. • Students will find all factors of a given number between 0 and 100. • Students will explain patterns they observe in numbers that have 2, 5, or 10 as factors.	
2 Prime and Composite Numbers	• No additional materials needed	Composite Factors Prime	• Students will find all factors of a given number between 0 and 100. • Students will explain patterns they observe in numbers that have 3, 6, or 9 as factors. • Students will determine if a number is prime or composite.	

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may only list some of the factors of a number. For example, they may forget to include 1 and the number itself or only include one number in a factor pair.	Finding Factor Pairs, Writing About Math, Practice, Check Your Understanding
	• Students may believe that all even numbers are composite numbers. However, 2 is prime because its only factors are 1 and itself. • Students may have difficulty identifying a number as a factor of another number if there is no pattern for that number. For example, 4 is a factor of 24 but there is no pattern for 4 as a factor.	Prime or Composite, Writing About Math, Practice, Check Your Understanding

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
3 Greatest Common Factor	• Math Fluency Sprint (2 per student) (Photocopy the Blackline Master at the end of this volume.)	Common factor Factor Greatest common factor (GCF)	• Students will find common factors between two whole numbers. • Students will identify the greatest common factor between two whole numbers.	
Concept Check-In and Remediation	Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to identifying factors of whole numbers.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Once students identify one common factor, they may have difficulty finding additional common factors, including the greatest common factor.	Common Factors, Finding the Greatest Common Factor, Writing About Math, Practice, Check Your Understanding
	• Students may only list some of the factors of a number. For example, they may not include 1 and the number itself or only include one number in a factor pair. • Students may believe that all even numbers are composite numbers. However, 2 is prime because its only factors are 1 and itself. • Students may have difficulty identifying a number as a factor of another number if there is no pattern for that number. For example, 4 is a factor of 24 but there is no pattern for 4 as a factor. • Once students identify one common factor, they may have difficulty finding additional common factors, including the greatest common factor.	

LESSON 1
Identifying Factors of Whole Numbers

Lesson Overview

In this lesson, students define factors and practice finding factors of a number. They use relationships between numbers and known multiplication facts to determine whether 2, 5, and 10 are factors of a given number.

Lesson Essential Question

- What is the relationship between a number and its factors?

Learning Objectives

In this lesson

- Students will define factors of a whole number.
- Students will find all factors of a given number between 0 and 100.
- Students will explain patterns they observe in numbers that have 2, 5, or 10 as factors.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a.i Find all factor pairs for a whole number in the range 1–100.

Vocabulary Check-In

factor, factor pairs

Materials List

- 24 Tiles (1 set per student)
- Hundreds Chart (1 per student)
- Crayons

Preparation

Photocopy the 24 Tiles Blackline Master and the Hundreds Chart Blackline Master at the end of the volume.

DIGITAL



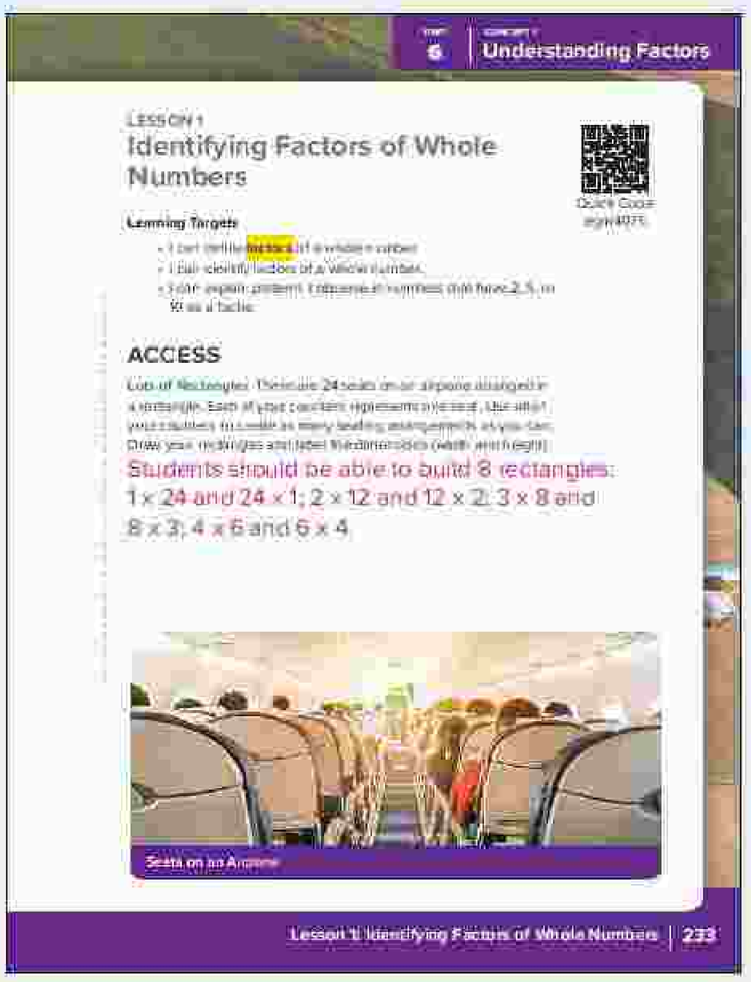
Lesson 1
Identifying Factors of Whole Numbers

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6 | Understanding Factors

LESSON 1

Identifying Factors of Whole Numbers

Learning Targets

ACCESS

Students should be able to build 8 rectangles: 1 × 24 and 24 × 1; 2 × 12 and 12 × 2; 3 × 8 and 8 × 3; 4 × 6 and 6 × 4

Seats on an Airplane

Lesson 1: Identifying Factors of Whole Numbers | 233

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may only list some of the factors of a number. For example, they may forget to include 1 and the number itself or only include one number in a factor pair.

Lots of Rectangles

1. Provide students with 24 tiles and ask them to turn to Lesson 1 ACCESS Lots of Rectangles.
2. Ask students to use all 24 tiles to create as many rectangles as they can. For each rectangle they create, they should draw a picture in their Student Edition and label the dimensions.
3. After a few minutes, ask students to share their drawings with a partner.
4. Ask volunteers to share draw their rectangles on the board and label the dimensions. Be sure to ask for students who have different responses from those already shared.

Answer Key for Lots of Rectangles:

Students should be able to build 8 rectangles:

1 × 24 and 24 × 1

2 × 12 and 12 × 2

3 × 8 and 8 × 3

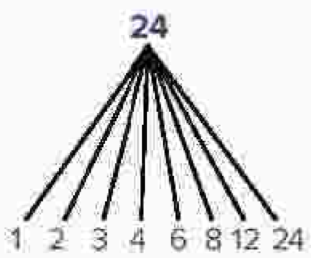
4 × 6 and 6 × 4

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BUILD (40 min)

Numbers with Factors of 2, 5, and 10 (20 min)

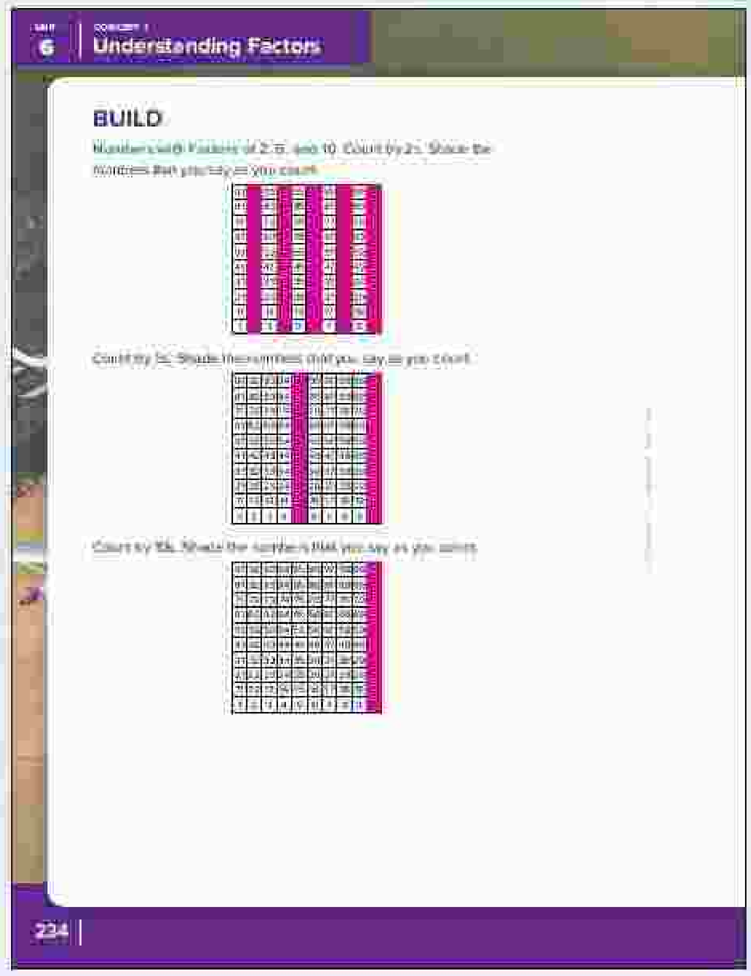
1. Explain to students that they are going to learn about factors today. Although it is a new term, they have already done some work with factors. Refer students to the work on the board and explain that they have listed the factors of 24. Factors are numbers that can be multiplied to form a given product.
2. Ask students to use the drawings on the board to identify the factors of 24. As students identify factor pairs, record them in a factor tree as shown.



3. Ask students to share what they notice about the factor tree. (Students may notice that the numbers are written in order, that each number has a line in the "tree," and that some of the numbers are factors of the other numbers.)
4. Tell students they will be investigating factors for other numbers. Ask students to turn to Lesson 1 BUILD: Numbers with Factors 2, 5, and 10.
5. Ask students to look at the first Hundreds chart and skip count aloud with you by 2s to 40. Direct students to quickly shade in the boxes for the numbers they say aloud.
6. Ask students to make predictions about the remaining numbers that will be shaded when counting by 2. Students may notice patterns: shading every other number, all of the numbers are even.
7. Repeat the procedure counting by 5s to 55 and then 10s to 100. Each time, ask students to make predictions about the remaining numbers that would be shaded if they continued counting. Students may notice patterns: all of the shaded numbers end in 5 or 0 when counting by 5s, all of the shaded numbers end in 0 when counting by 10s, both numbers form shaded columns.

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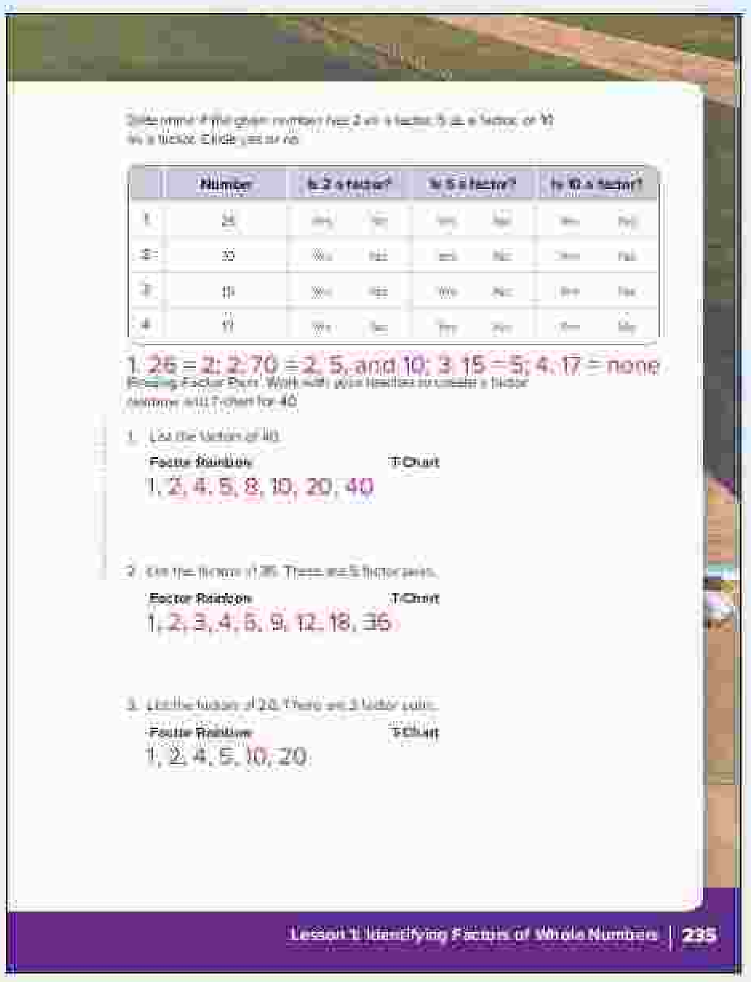


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Determine if the given number has 2 as a factor, 5 as a factor, or 10 as a factor. Circle yes or no.

	Number	Is 2 a factor?		Is 5 a factor?		Is 10 a factor?	
1	26	Yes	No	Yes	No	Yes	No
2	70	Yes	No	Yes	No	Yes	No
3	15	Yes	No	Yes	No	Yes	No
4	17	Yes	No	Yes	No	Yes	No

1. 26 = 2; 2. 70 = 2, 5, and 10; 3. 15 = 5; 4. 17 = none

Finding Factor Pairs: Work with your teacher to create a factor rainbow and T-chart for 40.

1. List the factors of 40.

Factor Rainbow　　T-Chart

1, 2, 4, 5, 8, 10, 20, 40

2. List the factors of 36. There are 5 factor pairs.

Factor Rainbow　　T-Chart

1, 2, 3, 4, 6, 9, 12, 18, 36

3. List the factors of 20. There are 3 factor pairs.

Factor Rainbow　　T-Chart

1, 2, 4, 5, 10, 20

Lesson 1: Identifying Factors of Whole Numbers | 235

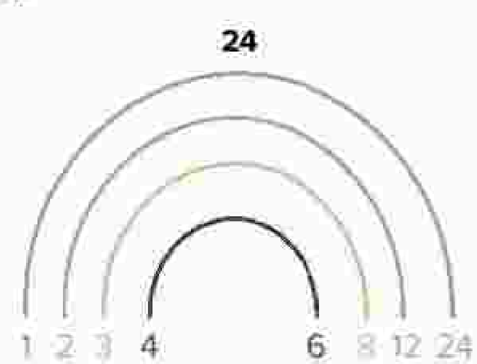
8. Explain to students that understanding number patterns can help them identify factors. For example, when we skip counted by 2s, we shaded only even numbers. That tells us that 2 is a factor of all even numbers.
9. Ask students to discuss what the patterns for 5 and 10 reveal about factors for the shaded numbers. Students should recognize that 5 is a factor of all of the shaded numbers on the 5s chart. 10 is a factor of all of the shaded numbers on the 10s chart. They may also recognize that 2, 5, and 10 can be factors of the same number, such as 10, 20, 30, and 40.
10. Direct students to Problem 1. Ask students to use what they know to determine if 26 has 2, 5, and/or 10 as a factor. Discuss the answers together.
11. Ask students to solve Problems 2–4, and then discuss the answers together.

Answer Key for Numbers with Factors of 2, 5, and 10:

1. 26 = 2
2. 70 = 2, 5, and 10
3. 15 = 5
4. 17 = none

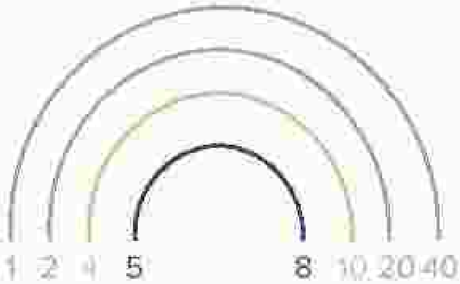
Finding Factor Pairs (20 min)

1. Direct students to Lesson 1 BUILD: Finding Factor Pairs.
2. Explain to students there are different ways to list factors. In addition to the factor tree (which they saw with 24), they can also create factor rainbows or factor T-charts.
3. Model how to create a factor rainbow for 24 (as shown).



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4. Model for students finding factors of 40 using factor pairs and creating a factor rainbow. Students should record the factors in their Student Edition. A suggested process follows:
   - Start with the factor pair 1 and 40.
     - o Explain that because of the Identity Property of Multiplication any number times 1 is equal to the number. Every number will have a factor pair of 1 and itself.
   - Next, identify 2 as a factor because 40 is even. Model finding the factor pair with 2. Since 2 × 20 is 40, 2 and 20 are the factor pair.
   - Continue identifying all of the factors of 40.
     - o Model the thinking process of using known facts and factor rules for 5 and 10, discovered earlier.
     - o Demonstrate trying out numbers in order to not miss any factors in the process. For example, think if there is a number that can multiplied by 3 to make 40. Since this is not possible, 3 is not a factor of 40.



Show students how to create a T-chart using the factors of 40.

1	40
2	20
4	10
5	8

5. Point out to students that since there is no factor pair for 40 with 6 or 7, they have found all the factor pairs because 8 is already listed. At this point, the factors will begin to repeat.

6. Ask students to work with a partner to complete Problems 2 and 3. With about 5 minutes left in BUILD, ask students to share their answers.

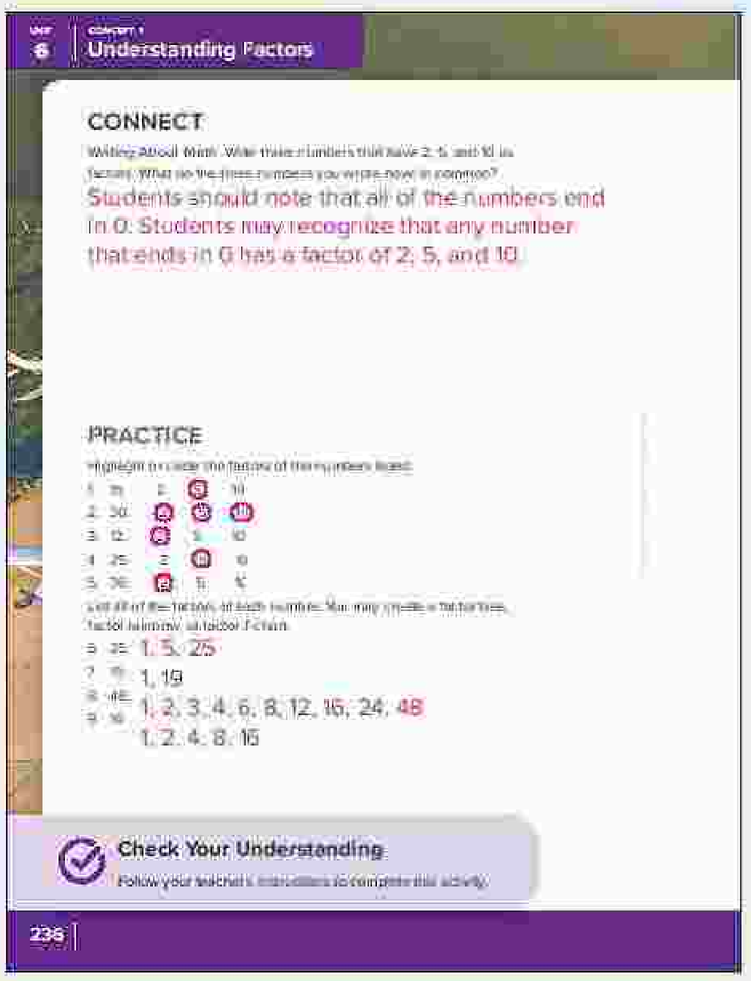
Answer Key for Finding Factor Pairs:

1. 1, 2, 4, 5, 8, 10, 20, 40
2. 1, 2, 3, 4, 6, 9, 12, 18, 36
3. 1, 2, 4, 5, 10, 20



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UNIT 6 | CONCEPT 1
Understanding Factors

CONNECT

Writing About Math. Write three numbers that have 2, 5, and 10 as factors. What do the three numbers you wrote have in common?

Students should note that all of the numbers end in 0. Students may recognize that any number that ends in 0 has a factor of 2, 5, and 10.

PRACTICE

6. 25 1, 5, 25

7. 19 1, 19

8. 48 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

9. 16 1, 2, 4, 8, 16

Check Your Understanding

Follow your teacher's instructions to complete this activity.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 1 CONNECT Writing About Math and ask them to respond to the journal prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

1. Ask volunteers to share the numbers they listed in their Writing About Math response along with their reasoning.
2. Discuss with the class what all of the numbers have in common.
   Students should note that all of the numbers end in 0. Students may recognize that any number that ends in 0 has a factor of 2, 5, and 10.

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PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions around finding factors.

Check Your Understanding

List all of the factors of each number. You may create a factor tree, factor rainbow, or factor T-chart.

1. 54: 1, 2, 3, 6, 9, 18, 27, 54
2. 28: 1, 2, 4, 7, 14, 28
3. Is 3 a factor of 29? Show your work and explain your reasoning.
   No, 3 is not a factor of 29. Sample reasoning: I know because when I count by 3s, I say 27 and then 30 and 29 is not a part of the list or no, because there is no number times 3 that equals 29.
4. Is 45 a factor of 5? Show your work and explain your reasoning.
   No, 45 is not a factor of 5. Sample reasoning: There is no whole number I can multiply by 45 that will equal 5 or 45 is not a factor of 5, but 5 is a factor of 45.

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Materials List

No additional materials needed

Preparation

No preparation needed

DIGITAL



Lesson 2

Prime and Composite Numbers

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LESSON 2
Prime and Composite Numbers

Lesson Overview

In this lesson, students use relationships between numbers and known multiplication facts to determine whether 3, 6, and 9 are factors of a number. Students also learn to categorize a number as prime or composite.

Lesson Essential Question

- What is the relationship between a number and its factors?

Learning Objectives

In this lesson

- Students will find all factors of a given number between 0 and 100.
- Students will explain patterns they observe in numbers that have 3, 6, or 9 as factors.
- Students will determine if a number is prime or composite.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a.i Find all factor pairs for a whole number in the range 1–100.

Vocabulary Check-In

composite, factors, prime

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may believe that all even numbers are composite numbers. However, 2 is prime because its only factors are 1 and itself.
- Students may have difficulty identifying a number as a factor of another number if there is no pattern for that number. For example, 4 is a factor of 24 but there is no pattern for 4 as a factor.

Factor Riddles

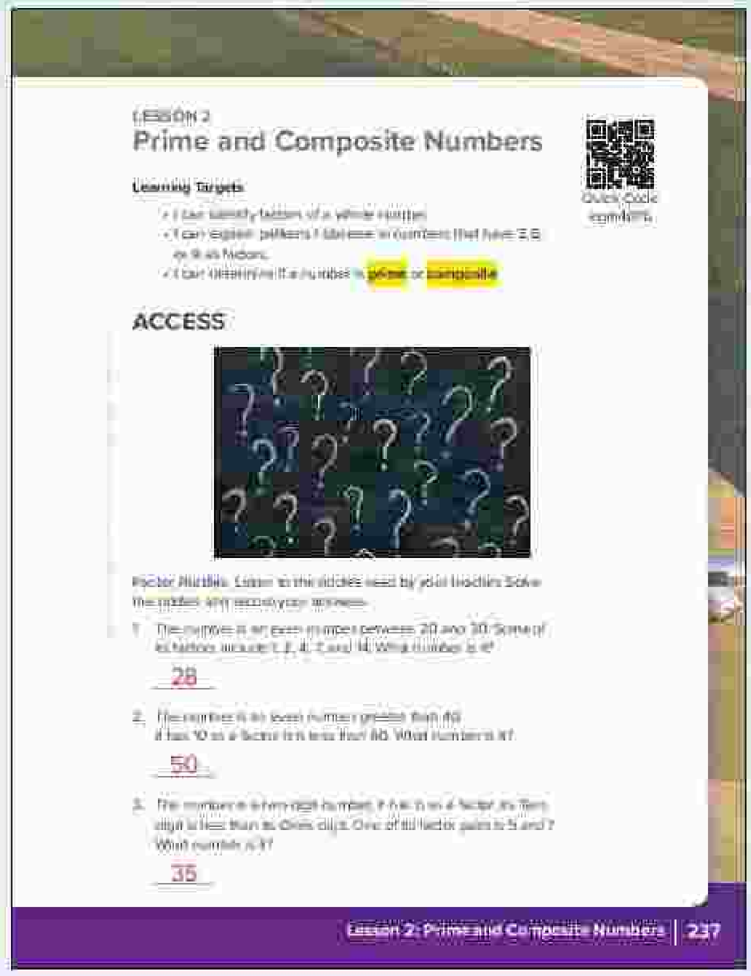
1. Direct students to Lesson 2 ACCESS Factor Riddles.
2. Read the riddles aloud to students and ask them to try to solve the riddles and record their answers.
   - I am an even number between 20 and 30. Some of my factors include 1, 2, 4, 7, and 14. What number am I?
   - I am a number greater than 40. I have a factor of 10. I am less than 60. What number am I?
   - I am a two-digit number. I have 5 as a factor. My Tens digit is less than my Ones digit. One of my factor pairs is 5 and 7. What number am I?
3. Ask students to briefly share their strategies for solving the riddles.

Answer Key for Factor Riddles:

1. 28
2. 50
3. 35

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LESSON 2

Prime and Composite Numbers

Learning Targets

ACCESS

1. 28
2. 50
3. 35

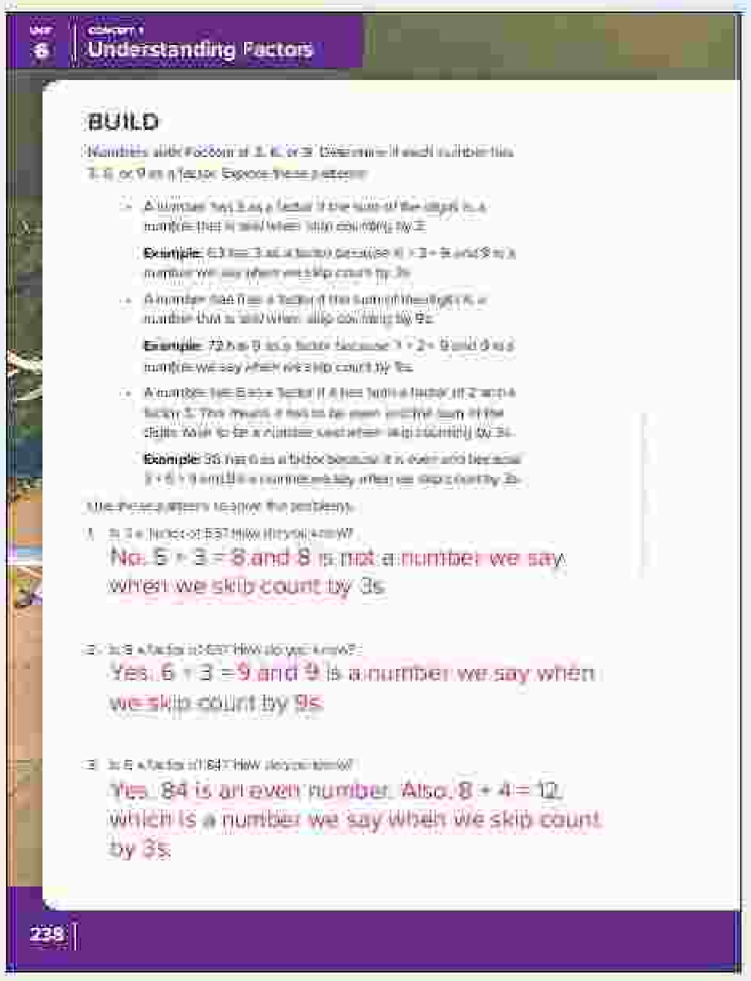
Lesson 2: Prime and Composite Numbers | 237

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UNIT 6 | CONCEPT 1 Understanding Factors

BUILD

1. No. 5 + 3 = 8 and 8 is not a number we say when we skip count by 3s.
2. Yes. 6 + 3 = 9 and 9 is a number we say when we skip count by 9s.
3. Yes. 84 is an even number. Also, 8 + 4 = 12, which is a number we say when we skip count by 3s.

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BUILD (40 min)

Numbers with Factors of 3, 6, or 9 (15 min)

1. Ask students to recall how they know a number has a factor of 2, 5, or 10. If necessary, remind students of the patterns they observed.
2. Share that there are also patterns for numbers that have factors of 3, 6, or 9. Direct students to Lesson 2 BUILD Numbers with Factors of 3, 6, or 9.
3. Write the patterns on the board for students to refer to while working.
    - A number has 3 as a factor if the sum of the digits is a number that is said when skip counting by 3.
        - Example: 3 is a factor of 63 because 6 + 3 = 9 and 9 is a number said when skip counting by 3s.
        - Non-example: 3 is not a factor of 71 because 7 + 1 = 8 and 8 is not a number said when skip counting by 3s.
    - A number has 9 as a factor if the sum of the digits is a number said when skip counting by 9s.
        - Example: 9 is a factor of 72 because 7 + 2 = 9 and 9 is a number said when skip counting by 9s.
        - Non-example: 9 is not a factor of 95 because 9 + 5 = 14 and 14 is not a number said when skip counting by 9s.
    - A number has 6 as a factor if it has a factor of 2 and a factor of 3. This means it has to be even and the sum of the digits have to be a number said when skip counting by 3s.
        - Example: 6 is a factor of 72 because it is even and 7 + 2 = 9 which is a number said when skip counting by 3s.
        - Non-example: 6 is not a factor of 57 because it is not even. 6 is also not a factor of 32 because 3 + 2 = 5, which is not a number said when skip counting by 3s.
4. Ask students to apply these patterns to solve Problems 1–3 in their Student Edition. After a few minutes, discuss the answers together.

Answer Key for Numbers with Factors of 3, 6, or 9:

1. No. 5 + 3 = 8 and 8 is not a number we say when we skip count by 3s.
2. Yes. 6 + 3 = 9 and 9 is a number we say when we skip count by 9s.
3. Yes. 84 is an even number. Also, 8 + 4 = 12, which is a number we say when we skip count by 3s.

Prime or Composite (10 min)

1. Remind students that numbers can be categorized as even or odd. Then, explain to students that numbers can also be categorized as prime or composite depending on their factors.
2. Direct students to Lesson 2 BUILD Prime or Composite. Define prime numbers (numbers with exactly two factors—1 and itself) and composite numbers (numbers with more than 2 factors).
3. Connect prime and composite to previous rectangle activity. Ask students to think about how many rectangles can be formed for prime numbers (just 1) and how many rectangles can be built for composite numbers (more than 1).

   TEACHER NOTE: 0 and 1 or not prime nor composite numbers, as they do not fit either definition.
4. Complete Problem 1 with students. Answer any questions students have about prime and composite numbers. Ask students to work with a partner to complete Problems 2–5. After a few minutes, go over the answers together.

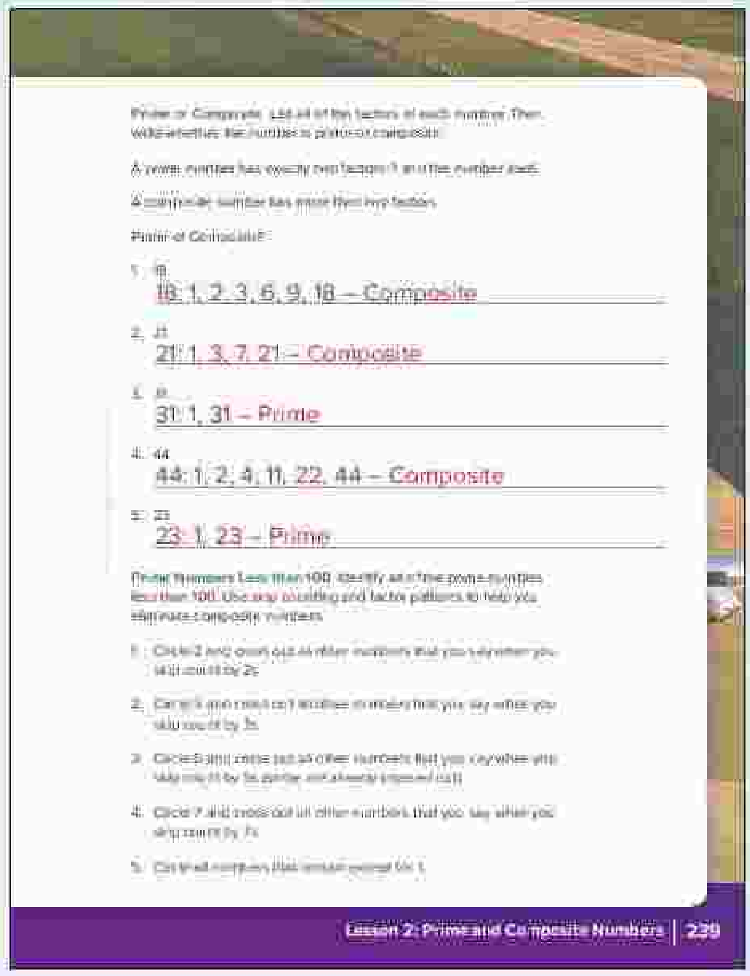
Answer Key for Prime or Composite:
1. 18: 1, 2, 3, 6, 9, 18 – Composite
2. 21: 1, 3, 7, 21 – Composite
3. 31: 1, 31 – Prime
4. 44: 1, 2, 4, 11, 22, 44 – Composite
5. 23: 1, 23 – Prime

Prime Numbers Less than 100 (15 min)

1. Assign students to groups of 4.
2. Direct students to Lesson 2 BUILD Prime Numbers Less than 100. Go over the directions and ask students to work with their group to find prime numbers.

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18: 1, 2, 3, 6, 9, 18 – Composite
21: 1, 3, 7, 21 – Composite
31: 1, 31 – Prime
44: 1, 2, 4, 11, 22, 44 – Composite
23: 1, 23 – Prime
Lesson 2: Prime and Composite Numbers | 239



Answer Key for Prime Numbers Less than 100:

X	X	X	X	X	X	97	X	X	X
X	X	83	X	X	X	X	X	89	X
71	X	73	X	X	X	X	X	79	X
61	X	X	X	X	X	67	X	X	X
X	X	53	X	X	X	X	X	59	X
41	X	43	X	X	X	47	X	X	X
31	X	X	X	X	X	37	X	X	X
X	X	23	X	X	X	X	X	29	X
11	X	13	X	X	X	17	X	19	X
1	2	3	X	5	X	7	X	X	X

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CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 2 CONNECT Writing About Math to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss their Writing About Math response with a partner and then with the class. Students should notice that 48 is composite and 53 is prime. Even though it would be better to have more seats, there is only 1 way to arrange 53 seats in a rectangle. It would not be a good idea to have 49 seats because they can only be arranged in a square, which would not be ideal for a ferry (this part of the response may be subject to personal experiences).

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UNIT 6 | Understanding Factors

When you are finished, the circled numbers are prime and the crossed out numbers are composite.

CONNECT

Writing About Math The seats on the new ferry will be arranged in a rectangle. Is it better for the ferry to have 48 seats or 53 seats? How do you know? Would 49 seats be a good idea? Use numbers, words, and pictures to explain your thinking.

Students should notice that 48 is composite and 53 is prime. Even though it would be better to have more seats, there is only 1 way to arrange 53 seats in a rectangle. It would not be a good idea to have 49 seats because they can only be arranged in a square, which would not be ideal for a ferry (this part of the response may be subject to personal experiences).

Seats on a ferry

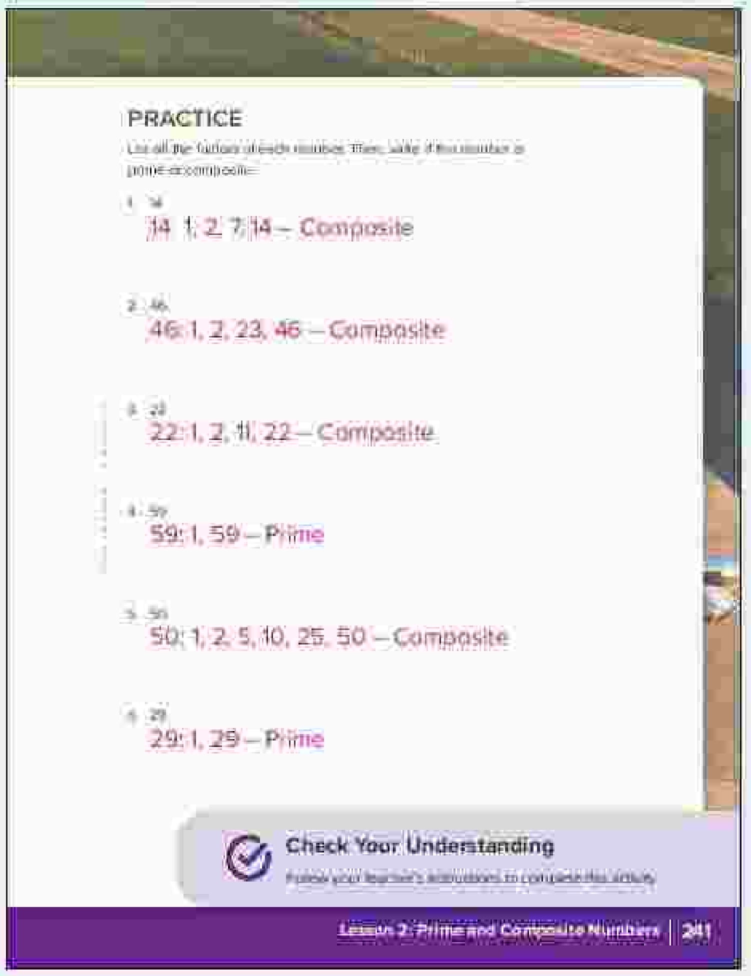
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PRACTICE

List all the factors of each number. Then, write if the number is prime or composite.

1. 14
14: 1, 2, 7, 14 – Composite

2. 46
46: 1, 2, 23, 46 – Composite

3. 22
22: 1, 2, 11, 22 – Composite

4. 59
59: 1, 59 – Prime

5. 50
50: 1, 2, 5, 10, 25, 50 – Composite

6. 29
29: 1, 29 – Prime

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 2: Prime and Composite Numbers | 241

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

List all the factors of each number. Then, write if the number is prime or composite.

1. 17: 1, 17 – Prime
2. 12: 1, 2, 3, 4, 6, 12 – Composite
3. 2: 1, 2 – Prime
4. 33: 1, 3, 11, 33 – Composite
5. 51: 1, 3, 17, 51 – Composite
6. 37: 1, 37 – Prime

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LESSON 3
Greatest Common Factor

Lesson Overview

In this lesson, students build on their understanding of factors to find the common factors of two numbers. Students then work to find the greatest common factor of two numbers.

Lesson Essential Question

- What is the relationship between a number and its factors?

Learning Objectives

In this lesson

- Students will find common factors between two whole numbers.
- Students will identify the greatest common factor between two whole numbers.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a.i Find all factor pairs for a whole number in the range 1–100.

4.C.2.c Find the greatest common factor between two whole numbers.

Vocabulary Check-In

common factor, factor, greatest common factor (GCF)

Materials List

Math Fluency Sprint (2 per student)

Preparation

Photocopy the Lesson 3 Math Fluency Sprint (found at the end of this volume).

DIGITAL



Lesson 3
Greatest Common Factor

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UNIT 6 | Understanding Factors

LESSON 3

Greatest Common Factor

Learning Targets

Quick Code

ACCESS

BUILD

1. 1, 2, 3, 6
2. 1, 2
3. 1, 2, 5, 10
4. 1, 7
5. 1

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Once students identify one common factor, they may have difficulty finding additional common factors, including the greatest common factor.

Math Fluency Sprint

1. Distribute a Math Fluency Sprint to each student.
2. On your start, provide students with 60 seconds to complete as many problems as possible.
3. Read the answers to students and have them check their work. (Consider having students swap papers and check each other's work.) Students should count how many problems they got correct and record their score at the top of the page.
4. Lead students in 30 seconds of toe touches while skip counting by 7s.
5. Give each student another Math Fluency Sprint. Tell students their goal is to try to answer more problems correctly than on the previous sprint.
6. On your start, provide students with 60 seconds to complete as many problems as possible.
7. Read answers to students and celebrate any student improvement.

BUILD (40 min)

Common Factors (20 min)

1. Remind students that they have been working to find factors of numbers. Explain that today they will work to find factors that two numbers have in common.
2. Model finding all of the common factors of 18 and 24 as follows.
    - Find all the factors of 18. Then list out the factors of 18 from least to greatest.

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- Find all the factors of 24. Then list out the factors of 24 from least to greatest.
- Circle all of the factors that are in both lists. These are the common factors.



18: 1, 2, 3, 6, 9, 18

24: 1, 2, 3, 4, 6, 12, 24

Common Factors: 1, 2, 3, 6

3. Ask students to share their thoughts on the following questions with a partner:
   - Do all pairs of numbers have common factors?
     All numbers share a factor of 1, but may not have any other common factors.
   - What do you think would happen if one of the numbers you are finding common factors for is a prime number?
     They would only share 1 as a common factor unless one of the numbers is a factor of the other as with 17 and 34, where 17 is a factor of 34.
4. Ask students to turn to Lesson 3 BUILD Common Factors. Ask students to work with a partner to complete Problems 1–5. As students work, walk around, and monitor their progress. Offer support to students who are struggling. If many students are struggling, consider having students work in pairs or small groups.
5. When students are finished, ask students to discuss their thoughts on the following questions with a partner:
   - Do all pairs of numbers have common factors?
     All numbers share a factor of 1, but may not have any other common factors.
   - What do you think would happen if one of the numbers you are finding common factors for is a prime number?
     They would only share 1 as a common factor unless one of the numbers is a factor of the other like 17 and 34, where 17 is a factor of 34.

Answer Key for Common Factors:

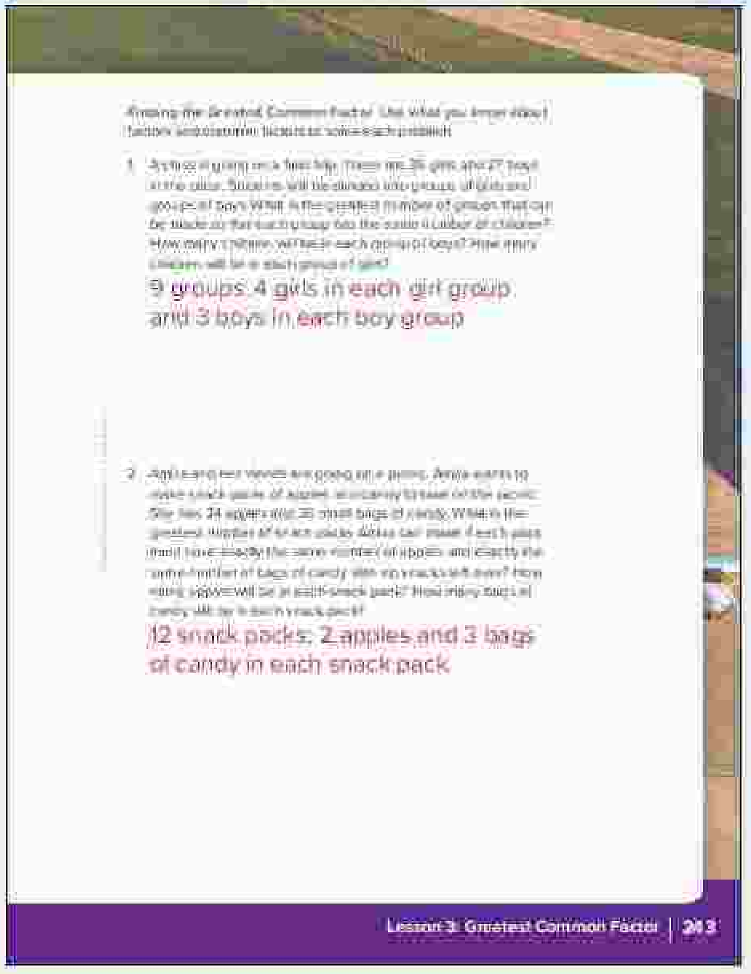
1. 36 and 42: 1, 2, 3, 6
2. 18 and 4: 1, 2
3. 20 and 30: 1, 2, 5, 10
4. 21 and 35: 1, 7
5. 17 and 22: 1

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9 groups; 4 girls in each girl group and 3 boys in each boy group

12 snack packs; 2 apples and 3 bags of candy in each snack pack

Lesson 3: Greatest Common Factor | 243

Finding the Greatest Common Factor (20 min)

1. Direct students to Lesson 3 BUILD Finding the Greatest Common Factor.
2. Read Problem 1 with students. Model your thinking of this problem as follows:
   - Explain what you know about the problem:
     - Girls will be divided into groups. Boys will be divided into groups. The groups must be the same size.
   - Explain what you are trying to find out.
     - I need to figure out how many groups the teacher can make all together. Then I need to know how many girls will be in each girl group and how many boys will be in each boy group.
   - Explain that you know that it would be possible to make 3 groups because 3 is a common factor of 36 and 27. The girl groups would have 12 girls and the boy groups would have 9 boys.
   - Reread the problem, emphasizing that it asks for the greatest number of groups that can be made. 3 is not the greatest number of groups that can be made.
   - List the factors of 36 and 27 on the board and ask students to identify the greatest common factor (or GCF) of the numbers. Since the GCF is 9, that means the greatest number of groups that can be made is 9, with 4 girls in each girl group and 3 boys in each boy group.

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3. Assign students into groups of 4 to work on the remaining problems. As students work, walk around, and monitor their progress. Offer support to students who are struggling. If many students are struggling, consider doing another example on the board.

Answer Key for Finding the Greatest Common Factor:

1. 9 groups; 4 girls in each girl group and 3 boys in each boy group
2. 12 snack packs; 2 apples and 3 bags of candy in each snack pack
3. 7 flower arrangements; 1 rose and 2 daisies in each flower arrangement
4. 10
5. 2
6. 11

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6 | CONCEPT 1
Understanding Factors

Flower Arrangement

7 flower arrangements; 1 rose and 2 daisies in each flower arrangement

4. Find the greatest common factor (GCF) of 80 and 50.
10

5. 2

6. 11

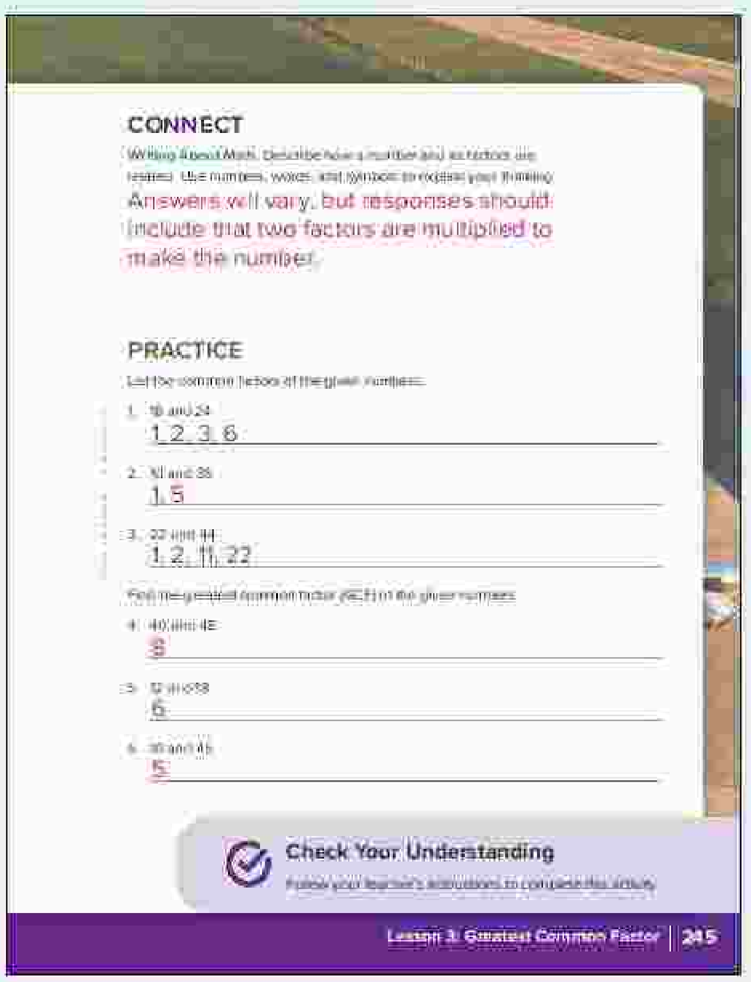
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CONNECT

Writing About Math: Describe how a number and its factors are related. Use numbers, words, and symbols to explain your thinking.

Answers will vary, but responses should include that two factors are multiplied to make the number.

PRACTICE

List the common factors of the given numbers.

1. 18 and 24
   1, 2, 3, 6
2. [illegible]
   1, 5
3. 22 and 44
   1, 2, 11, 22

Find the greatest common factor (GCF) of the given numbers.

4. 40 and 48
   8
5. 12 and 18
   6
6. [illegible]
   5

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 3: Greatest Common Factor | 245

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 3 CONNECT Writing About Math to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their Writing About Math response with a partner. Then, ask students to share with the class.

Answers will vary, but responses should include that two factors are multiplied to make the number.

PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Find the greatest common factor (GCF) of the given numbers.

1. 36 and 84: 12
2. 20 and 40: 20
3. 45 and 81: 9
4. 45 and 60: 15
5. 20 and 35: 5
6. 24 and 36: 12

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Understanding Factors. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Question

- What is the relationship between a number and its factors?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to identifying factors of whole numbers.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a.i Find all factor pairs for a whole number in the range 1–100.

4.C.2.c Find the greatest common factor between two whole numbers.

Vocabulary Check-In

Review concept vocabulary as needed.

Materials List

Materials may vary

Preparation

Preparation may vary

DIGITAL



Concept Check-In and Remediation

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COMMON MISCONCEPTIONS AND ERRORS

- Students may only list some of the factors of a number. For example, they may not include 1 and the number itself or only include one number in a factor pair.
- Students may believe that all even numbers are composite numbers. However, 2 is prime because its only factors are 1 and itself.
- Students may have difficulty identifying a number as a factor of another number if there is no pattern for that number. For example, 4 is a factor of 24 but there is no pattern for 4 as a factor.
- Once students identify one common factor, they may have difficulty finding additional common factors, including the greatest common factor.

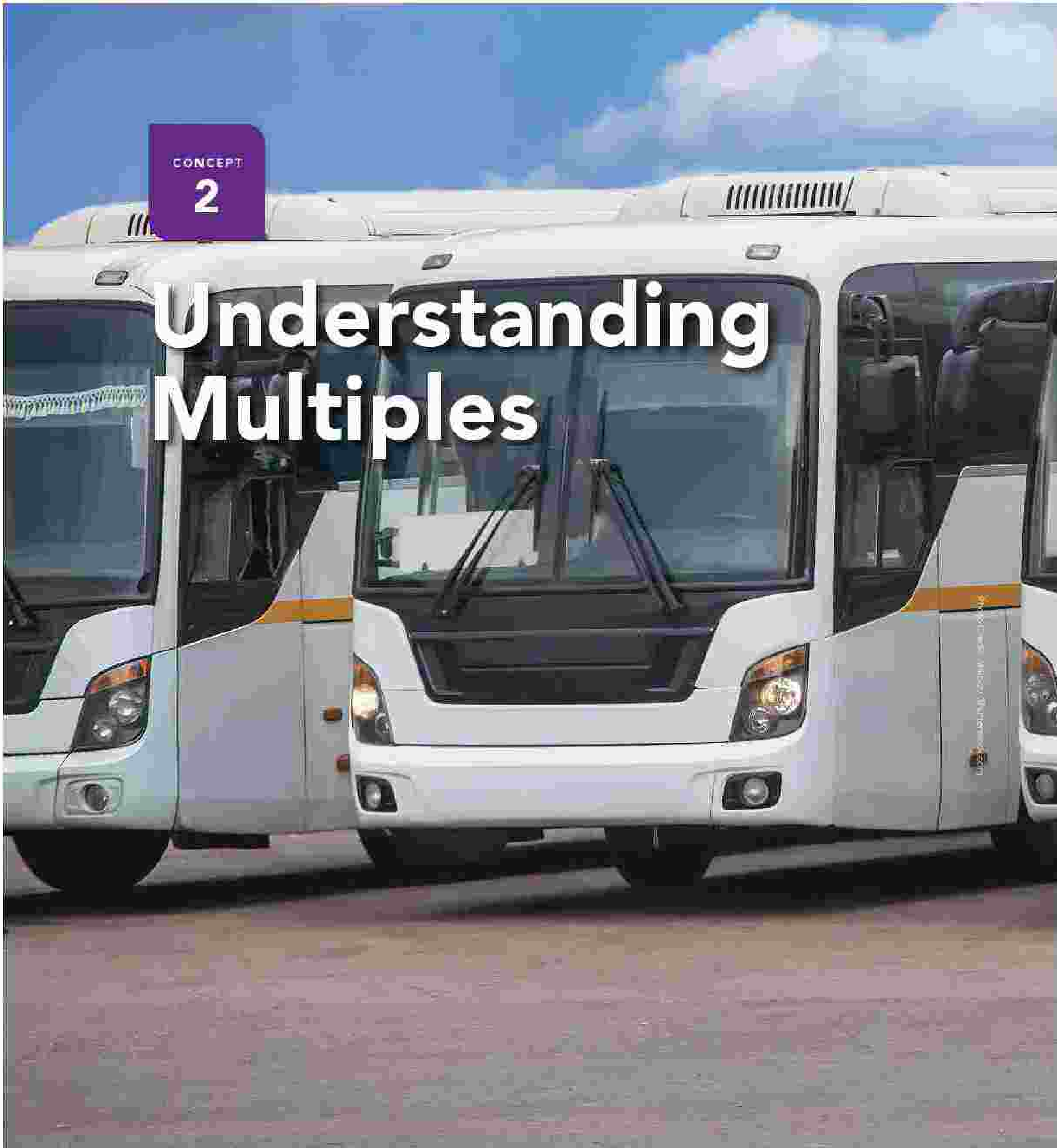
Remediation: Correcting Misconceptions

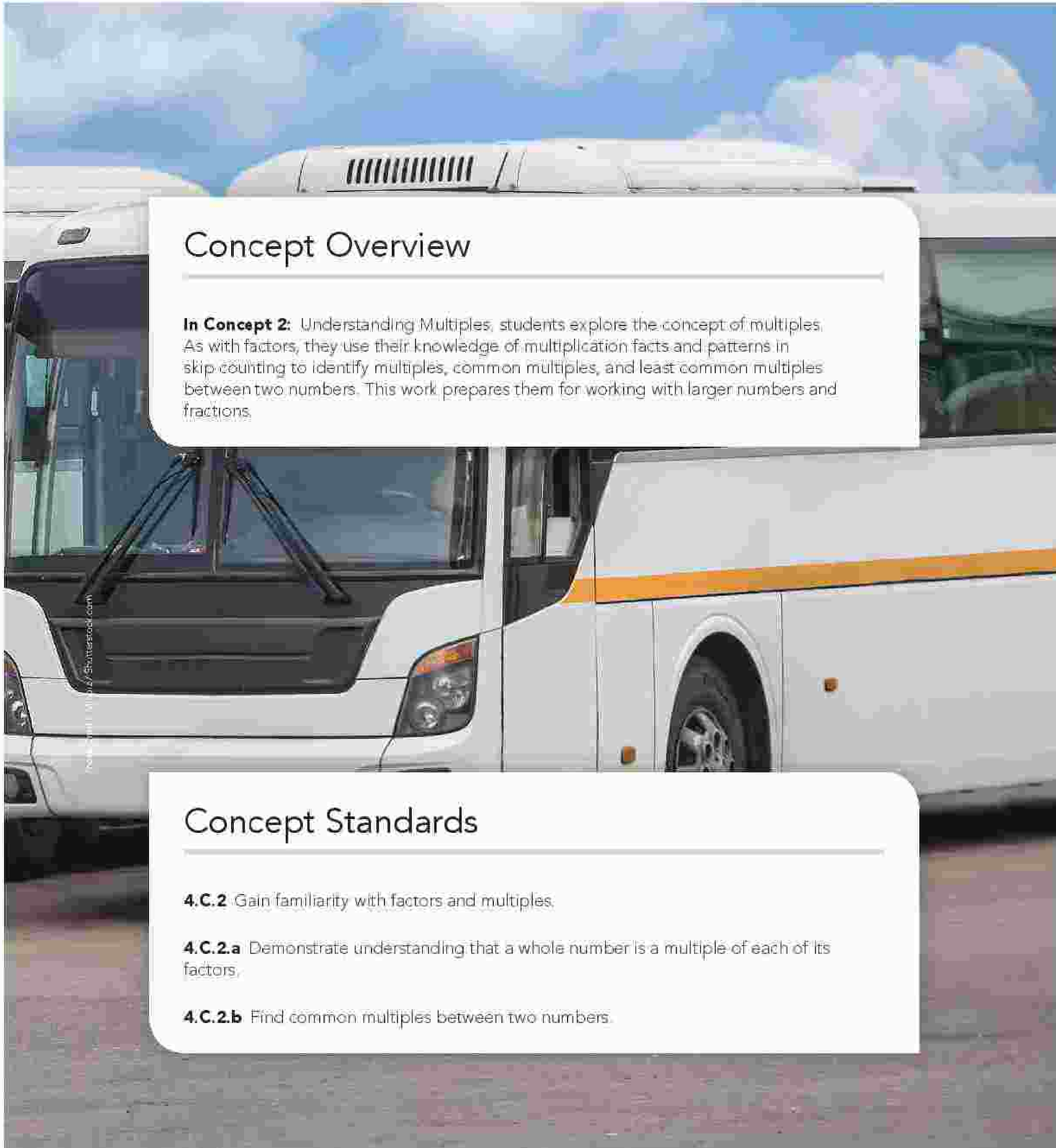
If. . .	**Then. . .**
Students struggle to find all of the factors of a number.	Review the patterns in Lessons 1 and 2. Make sure that students commit to one of the methods—the factor rainbow method or the T-chart method to systematically keep track of factor pairs starting with 1 and the number and then moving to 2 and then 3 and so on. Also, spend time helping students to figure out when the factors begin to repeat so that they know they have found them all. Additionally, remind students that multiplication facts can help them identify factors of a given number.
If. . .	**Then. . .**
Students have difficulty finding a common factor or the greatest common factor.	Review Lesson 3. Consider having students engage in a hands-on activity where they practice dividing objects into groups. Assign each student or group of students a different number of objects and ask whether it is possible to make 2 groups out of the number, 3 groups and so on. Numbers that can be divided into the same number of groups share that number as a common factor.



CONCEPT 2

Understanding Multiples





Concept Overview

In Concept 2: Understanding Multiples, students explore the concept of multiples. As with factors, they use their knowledge of multiplication facts and patterns in skip counting to identify multiples, common multiples, and least common multiples between two numbers. This work prepares them for working with larger numbers and fractions.

Concept Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a Demonstrate understanding that a whole number is a multiple of each of its factors.

4.C.2.b Find common multiples between two numbers.

Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
4 Identifying Multiples of Whole Numbers	• Large Hundreds Chart (1 for the teacher).(Photocopy the Lesson 5 Teacher Hundreds Chart or use it to create a transparency for an overhead projector.) • Hundreds Charts for Multiples (1 per student) (Photocopy the Lesson 5 Hundreds Charts for Multiples Blackline Master)	Multiples Skip count	• Students will define multiples of whole numbers. • Students will identify multiples of whole numbers.	
5 Common Multiples	• Multiple Match Blackline Master (1 page per pair of students)	Review vocabulary as needed	• Students will identify common multiples between two numbers.	
6 Relationships between Factors and Multiples	• Factors and Multiples Game Cards (1 set per pair of students) (Photocopy the Factors and Multiples Game Cards Blackline Master at the end of this volume.)	Common multiple Factor Multiples Product	• Students will explain the relationship between factors and multiples. • Students will determine if a number is a factor or a multiple of another number.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite. • Students may not identify 0 or the whole number itself as a multiple. However, students learned about the Zero Property of Multiplication and the Identity Property of Multiplication in the previous unit. • When identifying multiples on a Hundreds Chart, students may believe that the multiples of a number are in the column below it. This is only true for 2, 5, and 10.	Find the Patterns, Writing About Math, Practice, Check Your Understanding
	• Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite. • Students might stop at the first common multiple they identify and have difficulty finding more than one common multiple. • Students may simply multiply two numbers together to find a common multiple and therefore, have difficulty identifying more than one common multiple. While this is not incorrect, there are always other multiples shared by two numbers.	Writing About Math, Practice, Check Your Understanding
	• Students often confuse factors and multiples. Factors are numbers multiplied together to make a number, while multiples are the numbers said when counting by a number. • Students may have difficulty describing the relationship between factors and multiples in words. However, they should be able to describe the relationship using a pair of numbers as an example.	Making Connections, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.		

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite. • Students might stop at the first common multiple they identify and have difficulty finding more than one common multiple. • Students may simply multiply two numbers together to find a common multiple and therefore, have difficulty identifying more than one common multiple. While this is not incorrect, there are always other multiples shared by two numbers. • Students may have difficulty describing the relationship between factors and multiples in words. However, they should be able to describe the relationship using a pair of numbers as an example. • Students may not identify 0 or the whole number itself as a multiple. However, students learned about the Zero Property of Multiplication and the Identity Property of Multiplication in the previous unit. • When identifying multiples on a Hundreds Chart, students may believe that the multiples of a number are in the column below it. This is only true for 2, 5, and 10.	

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LESSON 4
Identifying Multiples of Whole Numbers

Lesson Overview

In this lesson, students define a multiple of a whole number. They use skip counting, patterns and known multiplication facts to identify multiples of whole numbers.

Lesson Essential Question

- What is the relationship between a number and its multiples?

Learning Objectives

In this lesson

- Students will define multiples of whole numbers.
- Students will identify multiples of whole numbers.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

Vocabulary Check-In

multiples, skip count

Materials List

- Large Hundreds Chart (1 for the teacher)
- Hundreds Charts for Multiples (1 per student)

Preparation

Photocopy the Lesson 5 Teacher Hundreds Chart or use it to create a transparency for an overhead projector.

Photocopy the Lesson 5 Hundreds Charts for Multiples Blackline Master.

DIGITAL



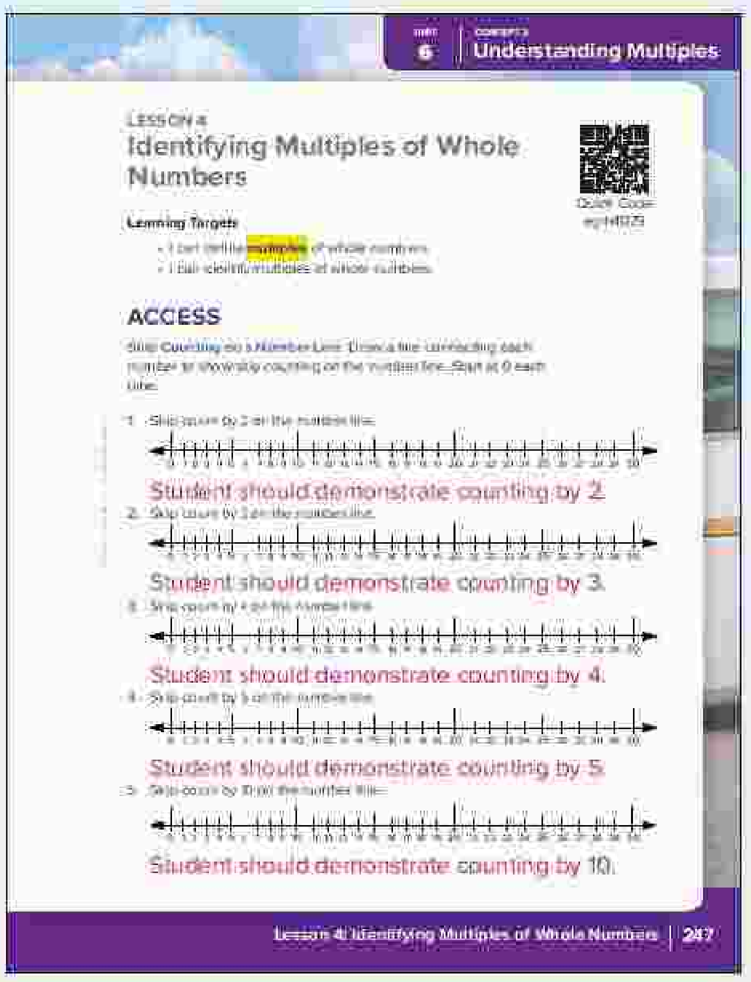
Lesson 4
Identifying Multiples of Whole Numbers

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UNIT 6 | CONCEPT 3 Understanding Multiples

LESSON 4

Identifying Multiples of Whole Numbers

Learning Targets

- I can define multiples of whole numbers.
- I can identify multiples of whole numbers.

ACCESS

Skip Counting on a Number Line. Draw a line connecting each number to show skip counting on the number line. Start at 0 each time.

1. Skip count by 2 on the number line.

Student should demonstrate counting by 2.

2. Skip count by 3 on the number line.

Student should demonstrate counting by 3.

3. Skip count by 4 on the number line.

Student should demonstrate counting by 4.

4. Skip count by 5 on the number line.

Student should demonstrate counting by 5.

5. Skip count by 10 on the number line.

Student should demonstrate counting by 10.

Lesson 4: Identifying Multiples of Whole Numbers | 247

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite.
- Students may not identify 0 or the whole number itself as a multiple. However, students learned about the Zero Property of Multiplication and the Identity Property of Multiplication in the previous unit.
- When identifying multiples on a Hundreds Chart, students may believe that the multiples of a number are in the column below it. This is only true for 2, 5, and 10.

Skip Counting on a Number Line

1. Direct students to Lesson 4 ACCESS Skip Counting on a Number Line.
2. Instruct students to skip count on each number line by drawing a line connecting each number starting with zero.
3. After about 7 minutes, ask students to compare their responses with a partner and make corrections, if necessary.

TEACHER NOTE: Students should begin skip counting at 0 because the Zero Property of Multiplication states that any number multiplied by 0 is 0. Then, remind students of the Identity Property of Multiplication when they say the number itself. For example, when skip counting by 2 they start with 0, 2, 4, and so on.

BUILD (40 min)

Color the Multiples (25 min)

1. Explain that multiples are the products we get when we multiply a given number. One way we can identify them is by skip counting by the given number. In fact, when students were skip counting by numbers in ACCESS, they were identifying multiples.

2. Ask students to turn to Lesson 4 BUILD Color the Multiples.

3. Connect skip counting on a number line to skip counting on the Hundreds chart. Distribute the Student Hundreds charts to students.

4. Go over the directions for the learning activity. Ask students to predict any visual patterns they might find. Ask students to work independently to color as they skip count. As students work, walk around and monitor their progress. Offer support as needed.

TEACHER NOTE: This may remind students of using the Hundreds chart in the previous concept to find factors. Explain to students that there is a relationship between factors and multiples that they will explore in this concept.

Find the Patterns (15 min)

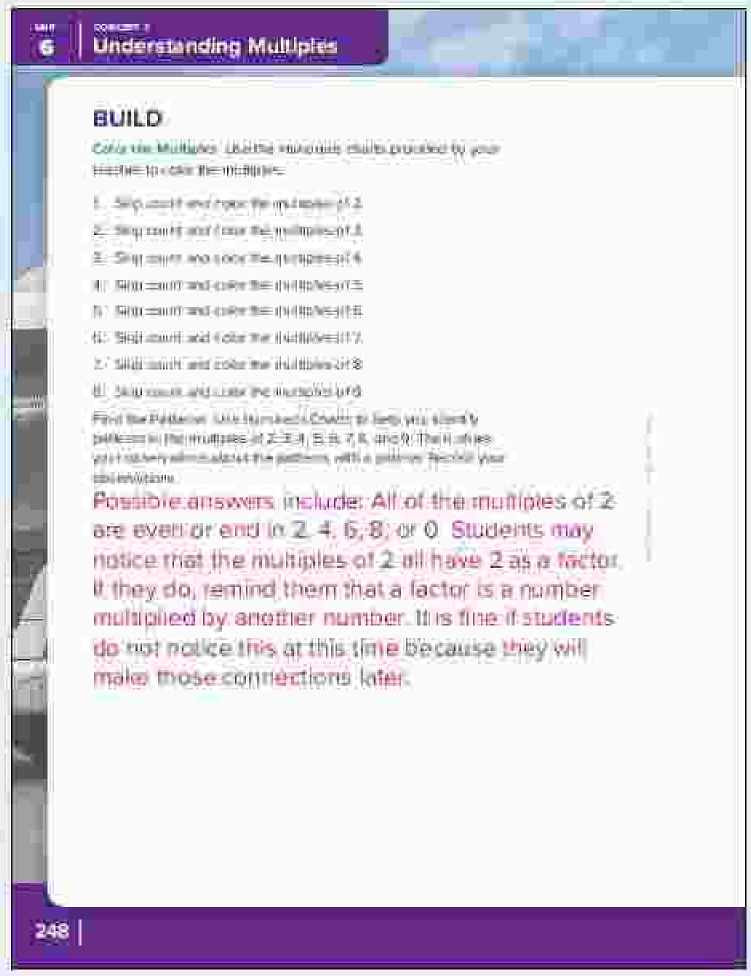
1. Direct students to Lesson 4 BUILD Find the Patterns. Explain to students that they will use their Hundreds charts to find patterns.

2. Ask students to look at their Hundreds chart with multiples of 2 colored in.

3. Use Think-Pair-Share to ask students what they notice about the numbers that are colored in. For the Think-Pair-Share strategy, provide students time to think about what they notice. Then, students share their thinking with a partner. Finally, call on a few students to share with the class.
   Possible answers include: All of the multiples of 2 are even, or end in 2, 4, 6, 8, or 0. Students may notice that the multiples of 2 all have 2 as a factor. If they do, remind them that a factor is a number multiplied by another number. It is fine if students do not notice this at this time because they will make those connections later.

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UNIT 6 | CONCEPT 2
Understanding Multiples

BUILD

Color the Multiples: Use the Hundreds charts provided by your teacher to color the multiples.

1. Skip count and color the multiples of 2.
2. Skip count and color the multiples of 3.
3. Skip count and color the multiples of 4.
4. Skip count and color the multiples of 5.
5. Skip count and color the multiples of 6.
6. Skip count and color the multiples of 7.
7. Skip count and color the multiples of 8.
8. Skip count and color the multiples of 9.

Find the Patterns: Use Hundreds Charts to help you identify patterns in the multiples of 2, 3, 4, 5, 6, 7, 8, and 9. Then share your observations about the patterns with a partner. Record your observations.

Possible answers include: All of the multiples of 2 are even or end in 2, 4, 6, 8, or 0. Students may notice that the multiples of 2 all have 2 as a factor. If they do, remind them that a factor is a number multiplied by another number. It is fine if students do not notice this at this time because they will make those connections later.

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Bus Stop

CONNECT

Writing About Math Taheni takes the bus home from school every day, but it does not take her directly to her house. After the bus drops Taheni off, she must walk the rest of the way home. The bus only takes stops every 4 kilometers as it leaves the school. If Taheni lives 18 km from school, how far does she have to walk home from the bus stop? Draw a picture to represent your thinking.

The bus will stop 4 km, 8 km, 12 km, 16 km, and 20 km from school. She lives 18 km from school, so the bus will stop 2 km away from where she lives. She must walk 2 kilometers in either direction to get home.

Lesson 4: Identifying Multiples of Whole Numbers | 249

4. Pair students together. Instruct students to write down patterns they notice about the multiples of 3, 4, 5, 6, 7, 8, and 9.
5. With about 5 minutes left in BUILD, ask students to share the patterns they observed with the class.

   TEACHER NOTE Students may make connections to the factor rules from Lessons 1 and 2. Again, this is fine but not necessary at this time. Students make those connections later.

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 4 CONNECT Writing About Math and respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Call on students to share with the class.
The bus will stop 4 km, 8 km, 12 km, 16 km, and 20 km from school. She lives 18 km from school, so the bus will stop 2 km away from where she lives. She must walk 2 kilometers in either direction to get home.

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PRACTICE

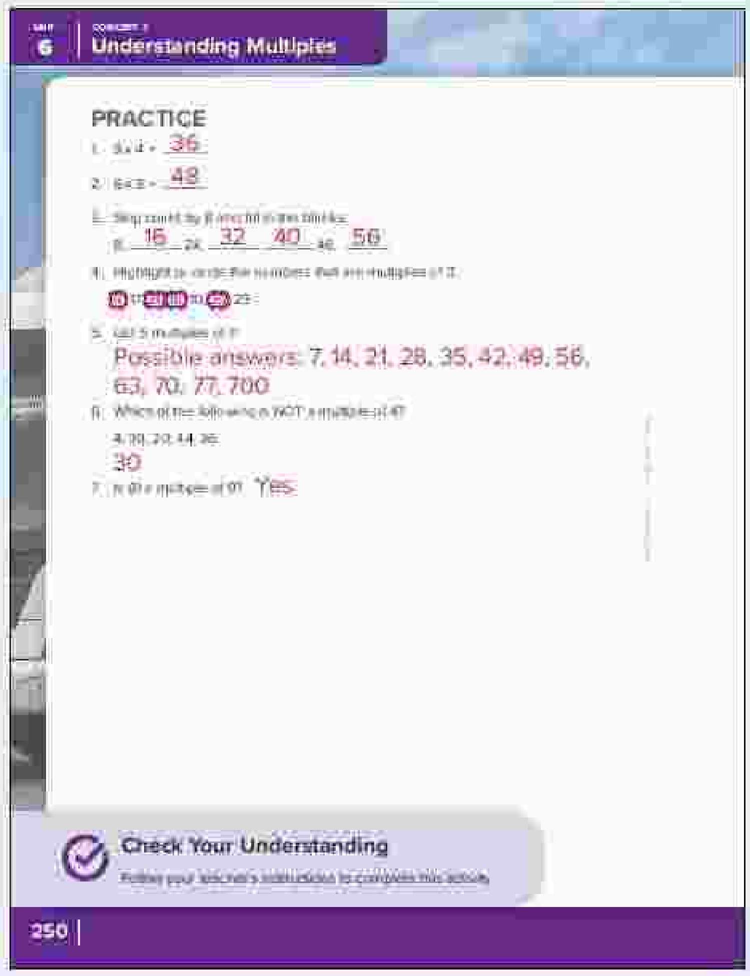
Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Write 4 multiples of 6: Possible answers: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 600
2. Write 4 multiples of 5: Possible answers: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60
3. Which number is a multiple of 9? 3, 17, 45, 56, 89

PRINT

Student Page 250


6 | Understanding Multiples

PRACTICE

1. 36
2. 48
3. 16, 32, 40, 56
5. Possible answers: 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 700
6. 30
7. Yes

Check Your Understanding

250

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LESSON 5
Common Multiples

Materials List

Multiple Match Blackline Master

Preparation

Photocopy one page per student of the Blackline Master for Multiple Match.

Photo Credit: [illegible] / Shutterstock.com

DIGITAL



Lesson 5
Common Multiples

Quick Code: egmt4080

Lesson Overview

In this lesson, students learn to identify common multiples of two numbers.

Lesson Essential Question

- What is the relationship between a number and its multiples?

Learning Objective

In this lesson

- Students will identify common multiples of two numbers.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.b Find common multiples between two numbers.

Vocabulary Check-In

Review vocabulary as needed.

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

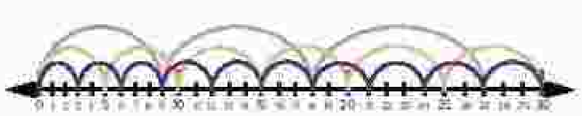
- Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite.
- Students might stop at the first common multiple they identify and have difficulty finding more than one common multiple.
- Students may simply multiply two numbers together to find a common multiple and therefore, have difficulty identifying more than one common multiple. While this is not incorrect, there are always other multiples shared by two numbers.

The Bus Stops Here

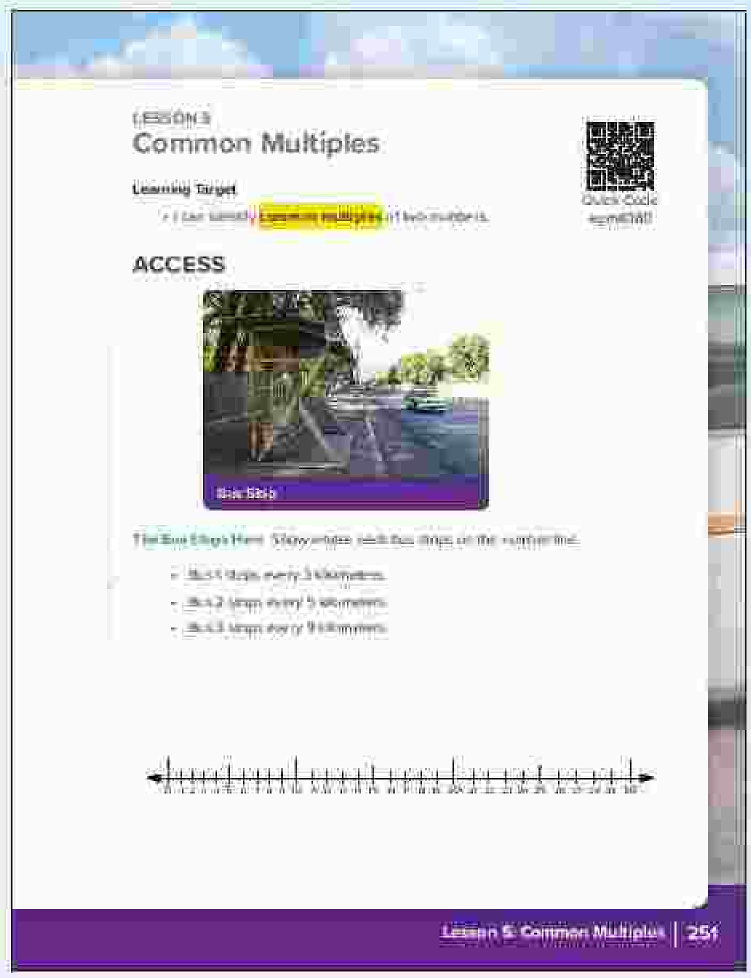
1. Ask students to turn to Lesson 5 ACCESS The Bus Stops Here.
2. Instruct students to show where each bus stops along the number line.
3. Ask students to discuss what they notice about the buses and where they stop.

TEACHER NOTE: Students do not have to come up with a correct answer here. However, they should be thinking about the factor rules they have learned for 3, 5, and 9.

Answer Key for The Bus Stops Here:
Possible answers include: Bus 1 and Bus 2 have 2 stops in common on the number line, Bus 1 stops at all of Bus 3's stops, all 3 buses do not have a stop in common on the number line. Ask students to talk with a partner to predict where all 3 buses might stop together.



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LESSON 5
Common Multiples

Learning Target
- I can identify common multiples of two numbers.

ACCESS

Bus Stop

The Bus Stops Here: Show where each bus stops on the number line.
- Bus 1 stops every 3 kilometers.
- Bus 2 stops every 5 kilometers.
- Bus 3 stops every 9 kilometers.

Lesson 5: Common Multiples | 251

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Unit 6 Concept 2 Understanding Multiples

BUILD

1. Common Multiples of 5 and 2: 10, 20, 30	2. Common Multiples of 3 and 4: 12, 24	3. Common Multiples of 8 and 2: 8, 16, 24
4. Common Multiples of 9 and 3: 9, 18, 27	5. Common Multiples of 2 and 6: 6, 12, 24	6. Common Multiples of 1 and 9: 9, 18, 27
7. Common Multiples of 4 and 5: 20, 40	8. Common Multiples of 8 and 4: 8, 16, 24	9. Common Multiples of 5 and 3: 15, 30

1. 5 and 7 35 and 70
2. 6 and 9 18 and 36
3. 6 and 8 24 and 48
4. 4 and 7 28 and 56

252

BUILD (40 min)

Multiple Match (30 min)

1. Assign students to work in pairs. Direct students to Lesson 5 BUILD Multiple Match.
2. Distribute the Multiple Match Blackline Master. One partner gets a Partner A set of cards. The other partner gets a Partner B set of cards.
3. Instruct students to look at Card 1 and write 10 multiples of the number on the card (partners have different numbers).
4. Instruct students to work with their partner to then record any multiples that are written on both of their cards. These are called common multiples.
5. Students repeat those steps with the remaining cards. Make sure both students are looking at their Card 2, Card 3, Card 4, and so on at the same time.
6. Go over the answers together, calling on partners to share their findings.

See the Similarities (10 min)

1. Ask students to turn to Lesson 5 BUILD See the Similarities.
2. Instruct students to find the common multiples of each pair of numbers. Encourage students to list the multiples if necessary.
3. After 8 minutes, have students share their work with a partner.
4. Lead the class in a discussion about what they noticed when finding the common multiples.

   TEACHER NOTE Consider highlighting Problems 1 and 2 in your discussion. In Problem 1, many students may not have 70 listed as a multiple of 5. Ask students how they know 70 is a multiple of 5 and 7 based on the patterns they identified in earlier lessons. For Problem 2, students likely identified 54 as a common multiple, as that is the product of 6 and 9. Invite students to share how they found other common multiples for this pair. Tell students that the product of the two numbers is always one of the common multiples, but there are often others.

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CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 5 CONNECT Writing About Math to respond to the prompt.

Answers may vary, but students should recognize that multiples are the products they get when they multiply a given number. Multiples can be identified by multiplying the given number or by skip counting by the given number. Students may realize that multiples can go on forever (though they do not need to include this in their response).

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask volunteers to share their thinking about the journal prompt. Encourage students to ask each other questions as they seek clarity and understanding. Writing About Math

PRACTICE

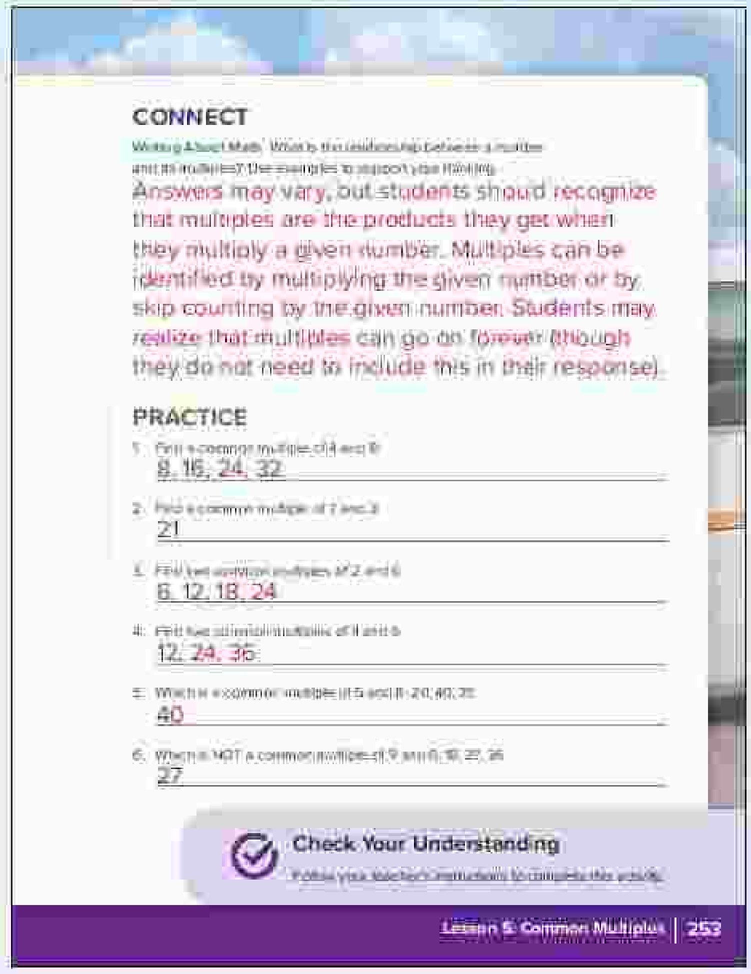
Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions around identifying common multiples.

Check Your Understanding

1. Is 16 a common multiple of 8 and 4? How do you know? Yes. Possible explanation: 8 times 2 is 16 and 4 times 4 is 16.
2. Write a common multiple of 3 and 6. Possible answers: 6, 12, 18, 24, 60
3. Which is a common multiple of 6 and 7? 7, 14, 36, 42

PRINT

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CONNECT

Answers may vary, but students should recognize that multiples are the products they get when they multiply a given number. Multiples can be identified by multiplying the given number or by skip counting by the given number. Students may realize that multiples can go on forever (though they do not need to include this in their response).

PRACTICE

1. 8, 16, 24, 32
2. 21
3. 6, 12, 18, 24
4. 12, 24, 36
5. 40
6. 27

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 5: Common Multiples | 253

Materials List

Factors and Multiples Game Cards (1 set per pair of students)

Preparation

Photocopy the Factors and Multiples Game Cards Blackline Master.

DIGITAL



Lesson 6

Relationships between Factors and Multiples

Quick Code: egmt4081

LESSON 6
Relationships between Factors and Multiples

Lesson Overview

In this lesson, students make connections between what they have learned about factors and multiples to determine if a given number is a factor or a multiple of another number. This can be challenging for some students, particularly if they confuse factors and multiples. However, this work is critical as it helps students build fluency in multiplication and division and prepares them to work with fractions with unlike denominators.

Lesson Essential Question

- How are multiples and factors related?

Learning Objectives

In this lesson

- Students will explain the relationship between factors and multiples.
- Students will determine if a number is a factor or a multiple of another number.

Grade-Level Standards

4.C.2.a Demonstrate understanding that a whole number is a multiple of each of its factors.

Vocabulary Check-In

common multiple, factor, multiples, product

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students often confuse factors and multiples. Factors are numbers multiplied together to make a number, while multiples are the numbers said when counting by a number.
- Students may have difficulty describing the relationship between factors and multiples in words. However, they should be able to describe the relationship using a pair of numbers as an example.

Multiples Riddles

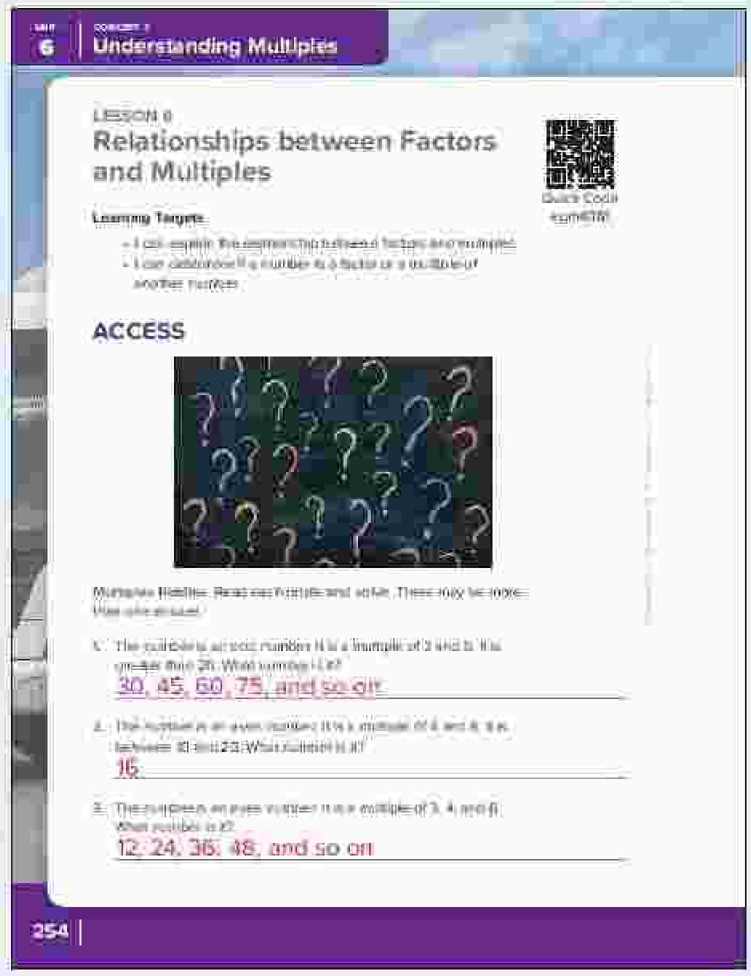
1. Direct students to Lesson 6 ACCESS Multiples Riddles and ask students to solve the riddles. Advise students that there may be more than one answer.
2. Ask students to share their answers and their reasoning for each riddle. Encourage students to ask questions of each other.

Answer Key for Multiples Riddles:

1. 30, 45, 60, 75, and so on
2. 16
3. 12, 24, 36, 48, and so on

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UNIT 6 | Understanding Multiples

LESSON 6

Relationships between Factors and Multiples

Learning Targets

ACCESS

30, 45, 60, 75, and so on

16

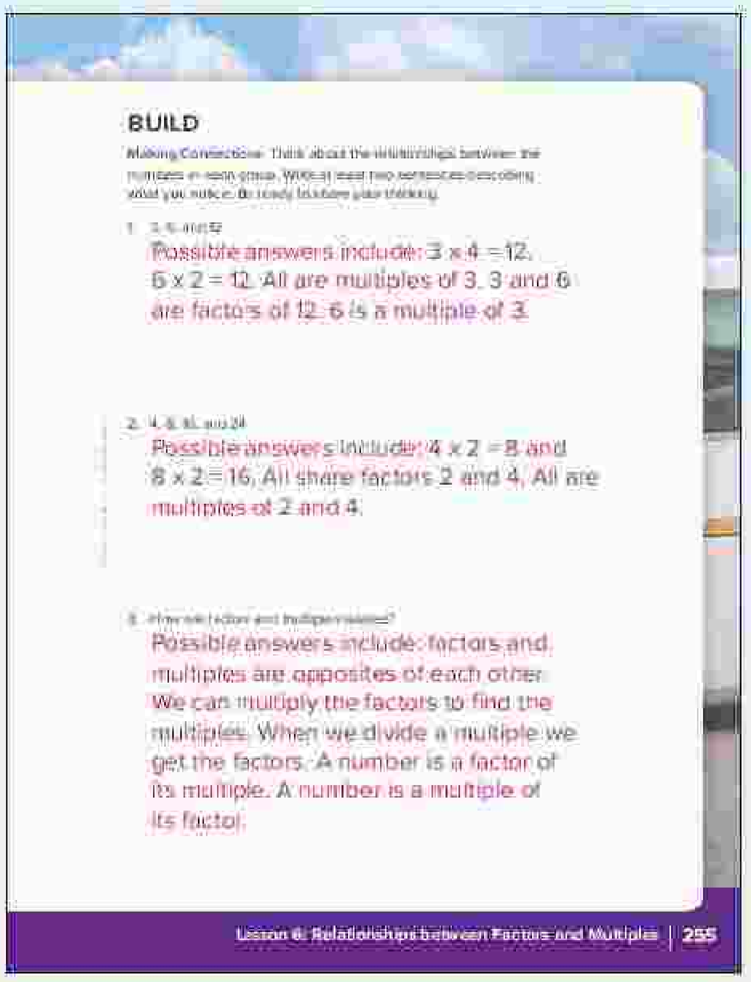
12, 24, 36, 48, and so on

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BUILD

Making Connections: Think about the relationships between the numbers in each group. Write at least two sentences describing what you notice. Be ready to share your thinking.

1. 3, 6, and 12
   Possible answers include: 3 × 4 = 12, 6 × 2 = 12. All are multiples of 3. 3 and 6 are factors of 12. 6 is a multiple of 3.

2. 4, 8, 16, and 24
   Possible answers include: 4 × 2 = 8 and 8 × 2 = 16. All share factors 2 and 4. All are multiples of 2 and 4.

3. How are factors and multiples related?
   Possible answers include: factors and multiples are opposites of each other. We can multiply the factors to find the multiples. When we divide a multiple we get the factors. A number is a factor of its multiple. A number is a multiple of its factor.

Lesson 6: Relationships between Factors and Multiples | 255

BUILD (40 min)

Making Connections (20 min)

1. Ask students to turn to Lesson 6 BUILD Making Connections Problem 1.
2. Ask students to write two sentences explaining how the numbers are related. Encourage students to think about factors and multiples.
3. Call on students to share out.
4. Direct students to complete the remaining problems.
5. Ask students to discuss their answers with a partner.
6. Invite students to share their thinking on how factors and multiples are related with the class.

Answer Key for Making Connections:

1. Possible answers include: 3 × 4 = 12, 6 × 2 = 12. All are multiples of 3. 3 and 6 are factors of 12. 6 is a multiple of 3.
2. Possible answers include: 4 × 2 = 8 and 8 × 2 = 16. All share factors 2 and 4. All are multiples of 2 and 4.
3. Possible answers include: factors and multiples are opposites of each other. We can multiply the factors to find the multiples. When we divide a multiple we get the factors. A number is a factor of its multiple. A number is a multiple of its factor.

Factors and Multiples Game (20 min)

1. Direct students to Lesson 6 BUILD Factors and Multiples Game.
2. Assign students to partners and distribute one set of Factors and Multiples Game Cards to each pair of students.
3. Game play: Students place the cards face down in a pile, shuffle them, and choose one. One partner finds factors of the number and the other partner finds multiples of the number. Students record their answers in their Student Edition. Then, they share their answers with their partner and record their partner's answers. If partners disagree, encourage students to help each other understand the difference between factors and multiples. Students then switch roles, choose another card, and continue game play.

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CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 6 CONNECT Writing About Math and respond to the prompt.
Possible responses are that factors and multiples are part of a multiplication sentence. When we learn our multiplication facts, we are able to find factors and multiples of a number more easily. For example, I know that 6 x 7 is 42. So I can quickly identify that factors of 42 are 6 and 7. If I know that 8 times 4 is 32, then I can quickly identify 32 as a multiple of 4 and of 8.

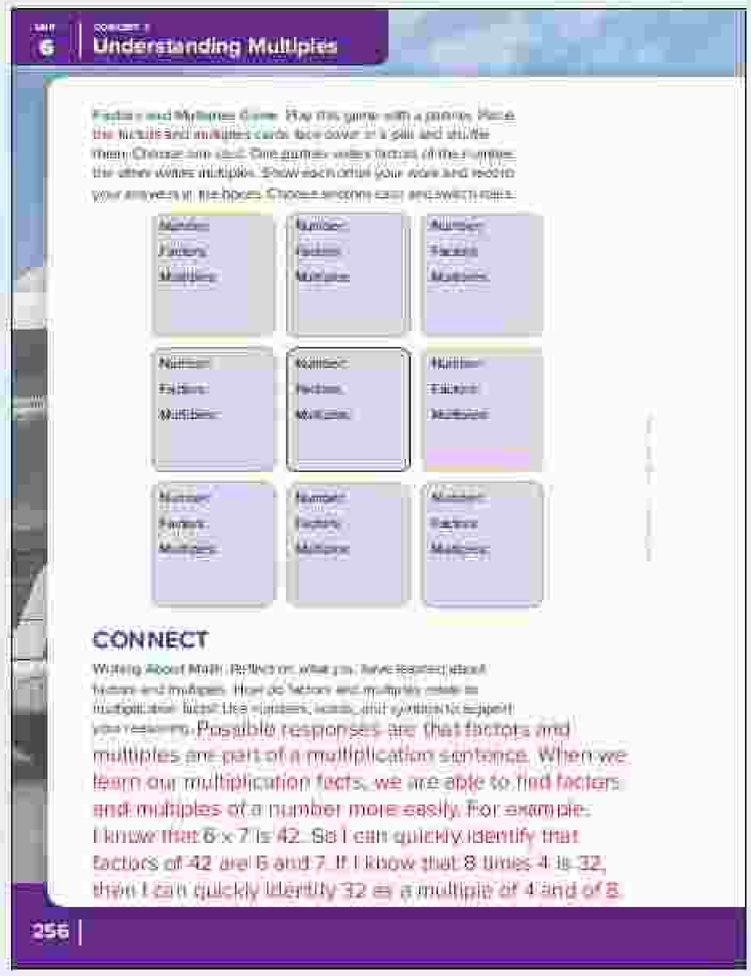
WRAP-UP (3 min)

Let's Chat About Our Learning

Instruct students to share their responses to the Lesson 6 CONNECT Writing About Math with a partner.

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UNIT 6 | CONCEPT 2
Understanding Multiples

Factors and Multiples Game. Play this game with a partner. Place the factors and multiples cards face down in a pile and shuffle them. Choose one card. One partner writes factors of the number, the other writes multiples. Show each other your work and record your answers in the boxes. Choose another card and switch roles.

Number: Factors: Multiples:	Number: Factors: Multiples:	Number: Factors: Multiples:
Number: Factors: Multiples:	Number: Factors: Multiples:	Number: Factors: Multiples:
Number: Factors: Multiples:	Number: Factors: Multiples:	Number: Factors: Multiples:

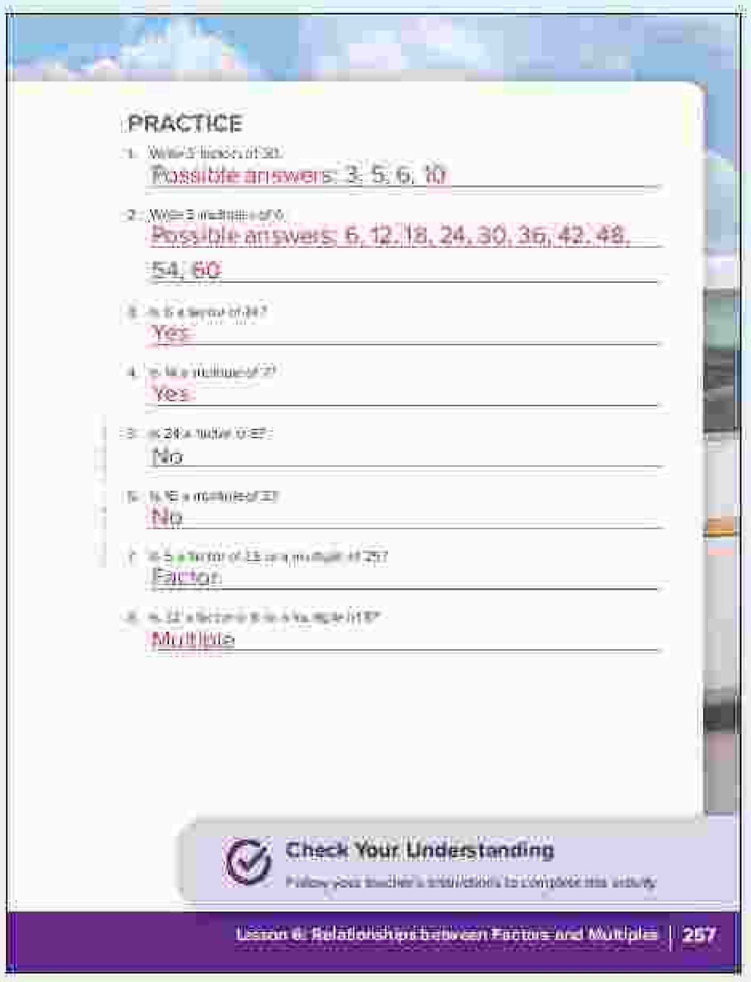
CONNECT

Writing About Math. Reflect on what you have learned about factors and multiples. How do factors and multiples relate to multiplication facts? Use numbers, words, and symbols to support your reasoning. Possible responses are that factors and multiples are part of a multiplication sentence. When we learn our multiplication facts, we are able to find factors and multiples of a number more easily. For example, I know that 6 x 7 is 42. So I can quickly identify that factors of 42 are 6 and 7. If I know that 8 times 4 is 32, then I can quickly identify 32 as a multiple of 4 and of 8.

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PRINT

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PRACTICE

1. Write 3 factors of 30.
   Possible answers: 3, 5, 6, 10
2. Write 3 multiples of 6.
   Possible answers: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60
3. [illegible]
   Yes
4. [illegible]
   Yes
5. [illegible]
   No
6. [illegible]
   No
7. [illegible]
   Factor
8. [illegible]
   Multiple

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 6: Relationships between Factors and Multiples | 257

PRACTICE

Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Is 7 a factor of 21 or a multiple of 21? Factor
2. Write a sentence explaining the relationship between 6, 4, and 24. Use the vocabulary factor and multiple. 6 and 4 are factors of 24. 24 is a multiple of 6. 24 is a multiple of 4.
3. Which of the following are factors of 12? 24, 6, 48, 4, 10
4. Which of the following is a multiple of 10? 5, 30, 2, 15, 1

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Understanding Multiples. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- What is the relationship between a number and its multiples?
- How are multiples and factors related?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to finding multiples of whole numbers.

Grade-Level Standards

4.C.2 Gain familiarity with factors and multiples.

4.C.2.a Demonstrate understanding that a whole number is a multiple of each of its factors.

4.C.2.b Find common multiples between two numbers.

Vocabulary Check-In

Review concept vocabulary as needed.

Materials List

Materials may vary

Preparation

Preparation will vary

DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4082

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COMMON MISCONCEPTIONS AND ERRORS

- Students often confuse factors and multiples. Factors are numbers multiplied together to make a number and are finite, while multiples are the products of a given number and are infinite.
- Students might stop at the first common multiple they identify and have difficulty finding more than one common multiple.
- Students may simply multiply two numbers together to find a common multiple and therefore, have difficulty identifying more than one common multiple. While this is not incorrect, there are always other multiples shared by two numbers.
- Students may have difficulty describing the relationship between factors and multiples in words. However, they should be able to describe the relationship using a pair of numbers as an example.
- Students may not identify 0 or the whole number itself as a multiple. However, students learned about the Zero Property of Multiplication and the Identity Property of Multiplication in the previous unit.
- When identifying multiples on a Hundreds chart, students may believe that the multiples of a number are in the column below it. This is only true for 2, 5, and 10.

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Remediation: Correcting Misconceptions

If. . .	Then. . .
Students confuse factors with multiples.	Review Lesson 4. Consider engaging students in additional practice where they list the factors of a number above the number and list the multiples of a number below the number. Point out to students that factors are mostly smaller than the number and that multiples are mostly larger than the number.
If. . .	**Then. . .**
Students stop at the first common multiple they identify. OR Students simply multiply two numbers together to find a common multiple.	Review Lesson 5. Students may benefit from remembering the factor rules for 2, 5, 10, 3, 6, and 9 from Concept 1. Draw the connection that this allows students to quickly see if a number is a multiple of a given number. Remind students that multiplying by friendly numbers such as 2, 5, and 10 can sometimes help them find additional common multiples.
If. . .	**Then. . .**
Students incorrectly state a number is a factor or a multiple.	Review Lesson 6. Consider making vocabulary flashcards to practice factors and multiples. Allow students to play the Factors and Multiples Games with a partner. Consider creating new cards with new and more challenging numbers.



UNIT

7

MULTIPLICATION AND DIVISION: COMPUTATION AND RELATIONSHIPS

Theme 2 | Mathematical Operations and Algebraic Thinking

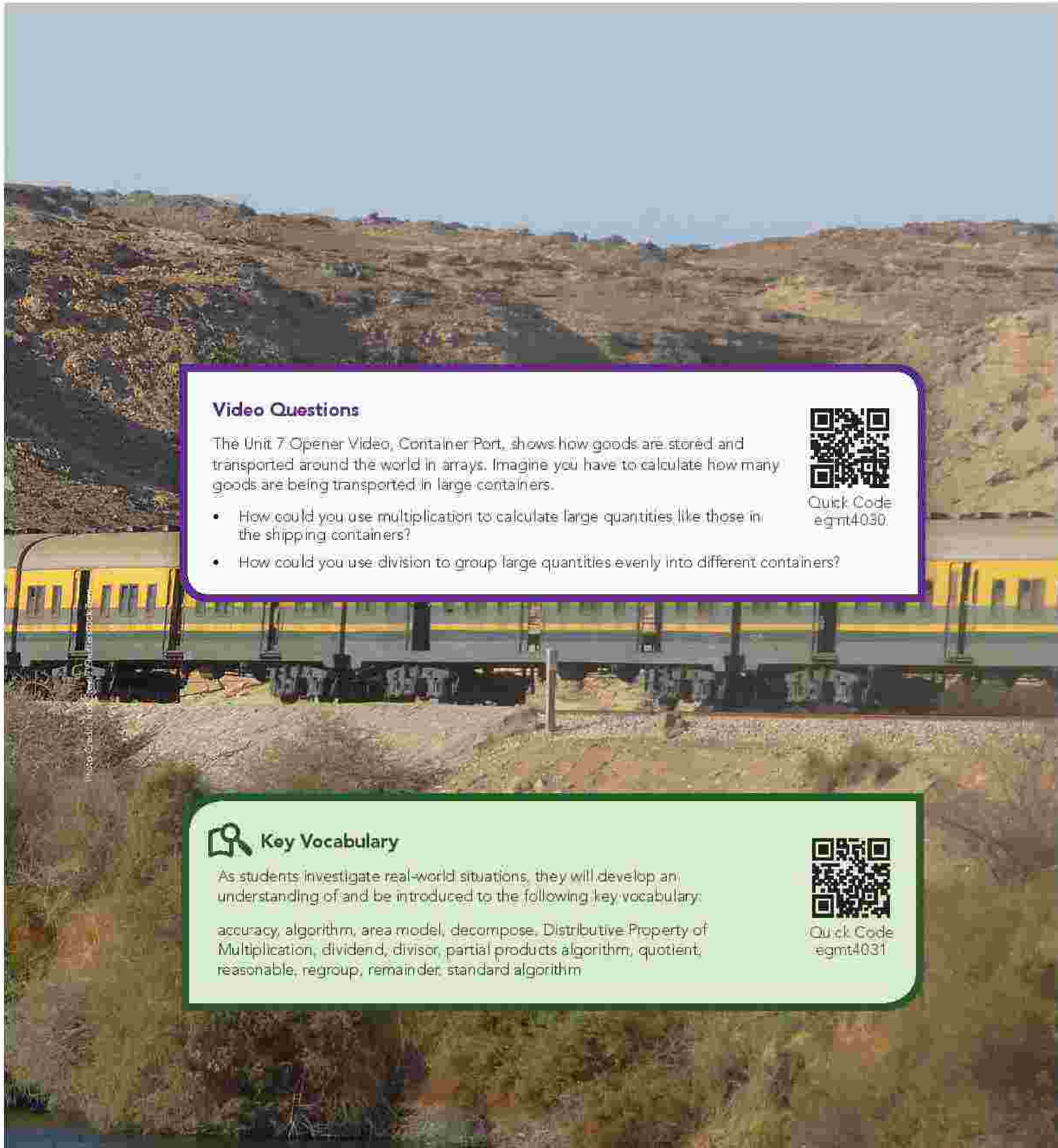
Unit 7 Multiplication and Division: Computation and Relationships

ESSENTIAL QUESTIONS

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?
- How do we use math to help us understand and solve real-world problems?

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

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Video Questions

The Unit 7 Opener Video, Container Port, shows how goods are stored and transported around the world in arrays. Imagine you have to calculate how many goods are being transported in large containers.

- How could you use multiplication to calculate large quantities like those in the shipping containers?
- How could you use division to group large quantities evenly into different containers?

Quick Code egmt4030

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

accuracy, algorithm, area model, decompose, Distributive Property of Multiplication, dividend, divisor, partial products algorithm, quotient, reasonable, regroup, remainder, standard algorithm

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Unit Storyline

Unit 7 Multiplication and Division: Computation and Relationships

The Multiplication and Division: Computation and Relationships unit extends students' working knowledge of multiplication and division of two 1-digit numbers and decomposing numbers. Students apply these understandings to the context of transportation. By observing video footage and investigating problems related to different modes of transportation, students enhance their understanding of multiplication and division.

Unit Standards

4.A.2	Use place value understanding and properties of operations to perform multidigit arithmetic.
4.A.2.b	Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.
4.A.2.c	Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.
4.A.2.d	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.
4.A.2.e	Illustrate and explain calculations using equations or models.
4.C.1.e	Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Unit 7 Structure and Pacing

This structure and pacing guide is based on a Mathematics program that is 60 minutes/ 5 days a week. See the Alternate Pacing Guides for recommendations for 45-minute and 90-minute lessons.

Concept 1: Multiplying by 1-Digit and 2-Digit Factors

Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?
- How do we use math to help us understand and solve real-world problems?

Lesson 1

The Area Model Strategy

Learning Objectives

- Students will use area models to represent two-digit by one-digit multiplication.
- Students will explain how they use place value to multiply.

Student Learning Targets

- I can use an area model to represent two-digit by one-digit multiplication.
- I can explain how I use place value to multiply.

Lesson 2

The Distributive Property

Learning Objectives

- Students will use an area model to multiply a one-digit number by a whole number with up to four digits.
- Students will explain the distributive property of multiplication.
- Students will apply the distributive property of multiplication to multiply a one-digit number by a whole number with up to four digits.

Student Learning Targets

- I can use an area model to multiply a one-digit number by a whole number with up to four digits.
- I can explain the distributive property of multiplication.
- I can apply the distributive property of multiplication to solve multiplication problems.

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Unit Structure and Pacing *cont'd*

Lesson 3	**The Partial Products Algorithm** **Learning Objective** • Students will use the partial products algorithm to multiply a one-digit number by a whole number with up to four digits. **Student Learning Target** • I can use the partial products algorithm to multiply a one-digit number by a whole number with up to four digits.
Lesson 4	**The Standard Multiplication Algorithm** **Learning Objectives** • Students will estimate products of multidigit multiplication problems. • Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits. **Student Learning Targets** • I can estimate products. • I can use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.
Lesson 5	**Review Connecting Strategies** **Learning Objective** • Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits. **Student Learning Target** • I can use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.
Lesson 6	**Two-Digit Multiplication** **Learning Objectives** • Students will identify patterns when multiplying two multiples of 10. • Students will multiply a two-digit number by a multiple of 10. • Students will assess the reasonableness of an answer using estimation and mental math. **Student Learning Targets** • I can identify patterns when multiplying two multiples of 10. • I can multiply a two-digit number by a multiple of 10. • I can assess the reasonableness of an answer using estimation and mental math.

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Lesson 7	**Area Models and Two-Digit Multiplication** **Learning Objective** • Students will use the area model to solve two-digit by two-digit multiplication problems. **Student Learning Target** • I can use the area model to solve two-digit by two-digit multiplication problems.
Lesson 8	**Algorithms and Two-Digit Multiplication** **Learning Objective** • Students will apply a variety of strategies to solve two-digit by two-digit multiplication problems. **Student Learning Target** • I can apply a variety of strategies to solve two-digit by two-digit multiplication problems.
Lesson 9	**Putting It All Together** **Learning Objectives** • Students will apply the Three Reads strategy to analyze and solve story problems. • Students will add, subtract, or multiply to solve story problems. **Student Learning Targets** • I can apply the Three Reads strategy to analyze and solve story problems. • I can add, subtract, or multiply to solve story problems.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to multiplying by one-digit and two-digit factors. **Student Learning Target** • I can correct my misconceptions and errors related to multiplying by one-digit and two-digit factors.

Multiplication and Division: Computation and Relationships



Concept 2: Dividing By 1-Digit Divisors

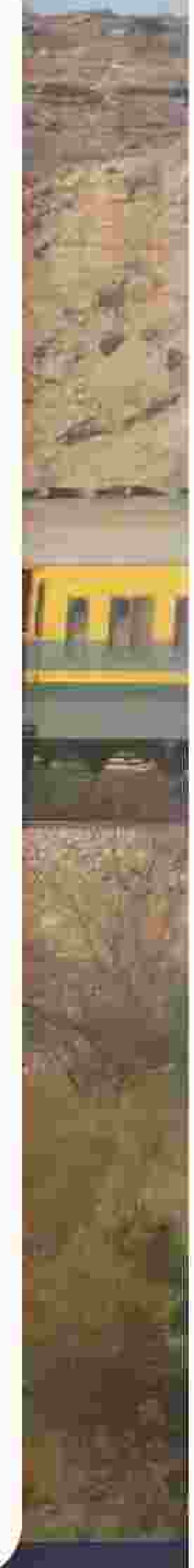
Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?
- How do we use math to help us understand and solve real-world problems?

Lesson	Content
Lesson 10	**Exploring Remainders** **Learning Objectives** • Students will identify the dividend, divisor, and quotient of a division problem. • Students will solve division problems. • Students will explain what a remainder represents in a division problem. **Student Learning Targets** • I can identify the dividend, divisor, and quotient of a division problem. • I can solve division problems. • I can explain what a remainder represents in a division problem.
Lesson 11	**Patterns and Place Value in Division** **Learning Objective** • Students will use place value, multiplication facts, and patterns with zeros to divide multiples of 10, 100, and 1,000 by one-digit divisors. **Student Learning Targets** • I can use place value, multiplication facts, and patterns with zeros to divide multiples of 10, 100, and 1,000 by one-digit divisors.
Lesson 12	**The Area Model and Division** **Learning Objective** • Students will use area models to represent and solve division problems. **Student Learning Target** • I can use area models to represent and solve division problems.

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Lesson 13	**The Partial Quotients Algorithm** **Learning Objective** • Students will use the partial quotients algorithm to divide dividends with up to four digits by one-digit divisors. **Student Learning Target** • I can use the partial quotients algorithm to solve division problems.
Lesson 14	**The Standard Division Algorithm** **Learning Objectives** • Students will apply their understanding of place value to solve division problems using the standard algorithm. • Students will estimate quotients using properties of place value and patterns in multiplication and division. **Student Learning Targets** • I can estimate quotients using properties of place value and multiplication and division patterns. • I can apply my knowledge of place value when using the standard algorithm for division.
Lesson 15	**Division and Multiplication** **Learning Objectives** • Students will use properties of place value to accurately record quotients. • Students will use the relationship between multiplication and division to check the accuracy of quotients. **Student Learning Targets** • I can use properties of place value to accurately record quotients. • I can use multiplication to check answers to division problems.



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Unit Structure and Pacing *cont'd*

Lesson 16	**Solving Challenging Story Problems** **Learning Objectives** • Students will organize information in story problems to determine when to add, subtract, multiply, or divide. • Students will solve story problems using addition, subtraction, multiplication, and division. **Student Learning Targets** • I can organize information in story problems to determine when to add, subtract, multiply, or divide. • I can use addition, subtraction, multiplication, and division to solve story problems.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct my misconceptions and errors related to dividing by one-digit divisors. **Student Learning Target** • I can correct my misconceptions and errors related to dividing by one-digit divisors.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

- Reduce ACCESS by 3 minutes
- Reduce BUILD by 8 minutes
- Reduce CONNECT by 2 minutes
- Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section:

- Discuss fewer examples
- Eliminate Shoulder Partner conversations
- Shorten class discussions
- Work with students to complete ACCESS problems

If Mathematics instruction is based on a combination of 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

- Follow the 45-minute approach for the 45-minute days
- Teach two 45-minute lessons on the 90-minute day

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

- Increase ACCESS by 5 minutes
- Increase BUILD by 20 minutes
- Increase CONNECT by 3 minutes
- Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section:

- Discuss additional examples as needed
- Extend class discussions
- Allow time for hands-on work with manipulatives and models
- Provide additional practice problems for students who need additional practice
- Encourage students to share and model their problem-solving strategies

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Mathematical Background Knowledge

Multiplication and division (along with fractions and decimals) are the major work of Primary 4. It is important that students are provided with ongoing opportunities throughout the school year to build understanding of and improve fluency in these areas.

Two-Digit by One-Digit Multiplication

In Primary 3, students multiplied two 1-digit numbers and built fluency multiplying within 100 by practicing a variety of strategies such as using manipulatives, drawing pictures, and building arrays. Students also discovered the importance of place value in understanding and building numbers and identified patterns when multiplying by multiples of 10. In Primary 4, they connect their understanding of multiplication as equal groups to visual models that allow them to develop an understanding of what is happening when they multiply two-digit numbers by one-digit numbers.

Students are reminded how arrays can be used to solve problems and learn how arrays are related to area models. An area model is a rectangular diagram which is more efficient for multidigit multiplication. The area of a rectangle is found by multiplying its length by its width. When using an area model for multiplication, the factors become the length and the width of the rectangle. The factors are then decomposed, or broken apart, using place value and the rectangle is divided accordingly into smaller rectangles. The product is the sum of the areas of the smaller rectangles. Students also apply the patterns they observed when multiplying by multiples of 10 in order to decompose, or break apart, numbers and use the area model to multiply a one-digit number by a number with up to four digits. Students explore the distributive property of multiplication as the property that makes it possible to decompose numbers when multiplying. The Distributive Property of Multiplication states that multiplying the sum of two or more addends by a number will have the same answer as multiplying each addend individually by the number and then adding the products together. Students will use the Distributive Property of Multiplication as an alternative way of recording the calculations which occur when using an area model.

Multiplication Algorithms

Students are introduced to the concept of an algorithm—a procedure or a set of steps to follow in order to perform an operation—and to the partial products algorithm for multiplication. The partial products algorithm is similar to using an area model but without the visual supports. This is important because it moves students along in their development from concrete to abstract representations of multiplication. When using the partial products algorithm, the problem is written vertically which will prepare students for the standard algorithm in upcoming lessons.

Finally, students are introduced to the standard algorithm for multiplication (up to 4 digits by 1 digit). It is important for students to be exposed to the standard algorithm as it is the most efficient strategy for multiplying. Place value is an important concept in this strategy as students must regroup in order to calculate products correctly. For example, if students

are multiplying 428 × 3, they will start by doing 8 × 3 = 24. They will need to know that 24 ones can be regrouped into 2 Tens and 4 Ones when using the standard algorithm. Students also practice estimating products in this lesson. They use estimation to help assess the reasonableness of their answers. Being able to mentally gauge whether an answer is correct based on an estimate is an essential skill in mathematics.

As part of their study of the standard algorithm, students analyze where grouping occurs and identify errors in using the standard algorithm, which is important in helping them correct their own misconceptions.

Two-Digit by Two-Digit Multiplication

Students apply their understanding of the Distributive Property and place value as they begin to multiply two 2-digit numbers. Students start by drawing on their knowledge of patterns when multiplying a one-digit number by a multiple of 10 to discover what happens when two multiples of 10 are multiplied. For example, students recall that 3 × 40 = 120 and extend this pattern to see that 30 × 40 = 1,200. Students should recognize the basic fact 3 × 4 and then place two zeros at the end of the product, one for each zero in both factors. Students then further their understanding of the Distributive Property of Multiplication by decomposing a two-digit number in order to multiply by a multiple of 10. Students utilize estimation and mental math in this lesson and discuss whether answers are reasonable, or whether they make sense given the relative size of the factors.

Students further their understanding of area models and discover how to use them to solve two-digit by two-digit multiplication problems. Once again, students draw on their knowledge of the Distributive Property of Multiplication and decompose both two-digit factors in order to multiply. Since they are multiplying two 2-digit numbers, their area models will have four sections and four partial products. This strategy allows students to better understand the partial products algorithm and the standard algorithm for two-digit multiplication. Students build on the area model for two-digit by two-digit multiplication by practicing the partial products algorithm. They then connect the partial products algorithm to the standard algorithm for multiplication. Students discuss the need for efficiency when solving multidigit multiplication problems and practice estimating to determine if their answer is reasonable. It is likely that students will not master the standard algorithm at this time. Continue to give students opportunities to practice multiplying throughout Primary 4.

In Primary 3, students solved two-step story problems involving addition, subtraction, multiplication, and division. In order to successfully solve story problems, students must first think about what is happening in the problem. Then, they must choose which operation is needed to solve. More than one operation is sometimes necessary. Students are introduced to the Three Reads strategy. This strategy is designed to help students understand a problem by reading the problem a number of times, each time with a different purpose. They read the problem once to understand what is happening in the problem, a second time to think about the numbers in the problem and what they might mean, and a third time to think about what question the problem could be asking.

In Primary 3, students worked on building their conceptual understanding of multiplication and division. They explored different word problems and learned to describe multiplication and division problems as containing "equal groups" of objects. In Primary 4, students recall how multiplication and division are related operations and how multiplication can be used

to help solve division problems. To begin, students learn the vocabulary associated with division. The dividend is the number that is being divided into equal groups. The divisor is the number of equal groups or the number in each group depending on the context of the problem. The quotient is the answer to a division problem, either the number of equal groups or the number in each group depending on the context of the problem. Students also explore what happens when the dividend cannot be equally divided by the divisor and are introduced to remainders in division problems. This will prepare students for dividing by one-digit divisors in upcoming lessons.

Students deepen their understanding of division by dividing multiples of 10, 100, and 1,000 and identifying patterns related to place value. It is helpful to recall the patterns of multiplication that students learned previously, since the patterns are similar for division. Students practice finding related facts and then adjusting the number of zeros in the quotient ($4{,}200 \div 6 = 700$). Recognizing patterns related to place value helps students develop an understanding of dividing dividends with up to four digits using models and algorithms.

Division Algorithms

Students first learn how to use an area model for division. When using this model, students must think about decomposing the dividend into parts that can be evenly divided by the divisor. Therefore, there are multiple ways to correctly decompose a dividend using this method. When dividing $256 \div 8$ for example, the dividend could be decomposed as $240 + 16$, as $160 + 80 + 16$, or $80 + 80 + 80 + 8 + 8$, all of which are correct. Students then calculate the quotient by figuring out how many groups of 8 they have. No matter how they decompose the dividend, there are 32 groups of 8. Any amount left over that cannot be evenly divided becomes the remainder. This is an important step for students in developing concrete knowledge of division before they move on to work with more abstract algorithms for division.

In Primary 4, students explore the relationship between division and repeated subtraction. Students think about how many times the divisor can be subtracted from the dividend ($24 - 6 - 6 - 6 - 6 = 0$ so $24 \div 6 = 4$). Then, students are introduced to the partial quotients algorithm for division. Just as with the area model, students have to decompose the dividend into multiples of the divisor. Students must think about the patterns of multiplication and division that they have learned and utilize their knowledge of place value to accurately determine the parts of the quotient. When using the partial quotients algorithm, there are multiple ways students can decompose the dividend and still arrive at a correct solution. The partial quotients algorithm is performed vertically like the standard algorithm for division, which is introduced in the next lesson. Both of these methods help students develop their understanding of division before students are introduced to the standard algorithm.

To prepare for using the standard algorithm, students do a Quick Draw of the dividend in Base Ten block drawings. In $490 \div 3$, students draw one Hundred in each of the three groups. Students then regroup the one Hundred left over. In division, regrouping occurs from left to right in a dividend. The one Hundred that is left over is regrouped into 10 Tens before students continue to divide. Seeing this process helps students make connections when they are introduced to the standard algorithm. Students are likely not to master using the standard algorithm at this time. However, it is important for them to be exposed to and to practice this method prior to Primary 5 when they will be expected to fluently divide multidigit whole numbers.

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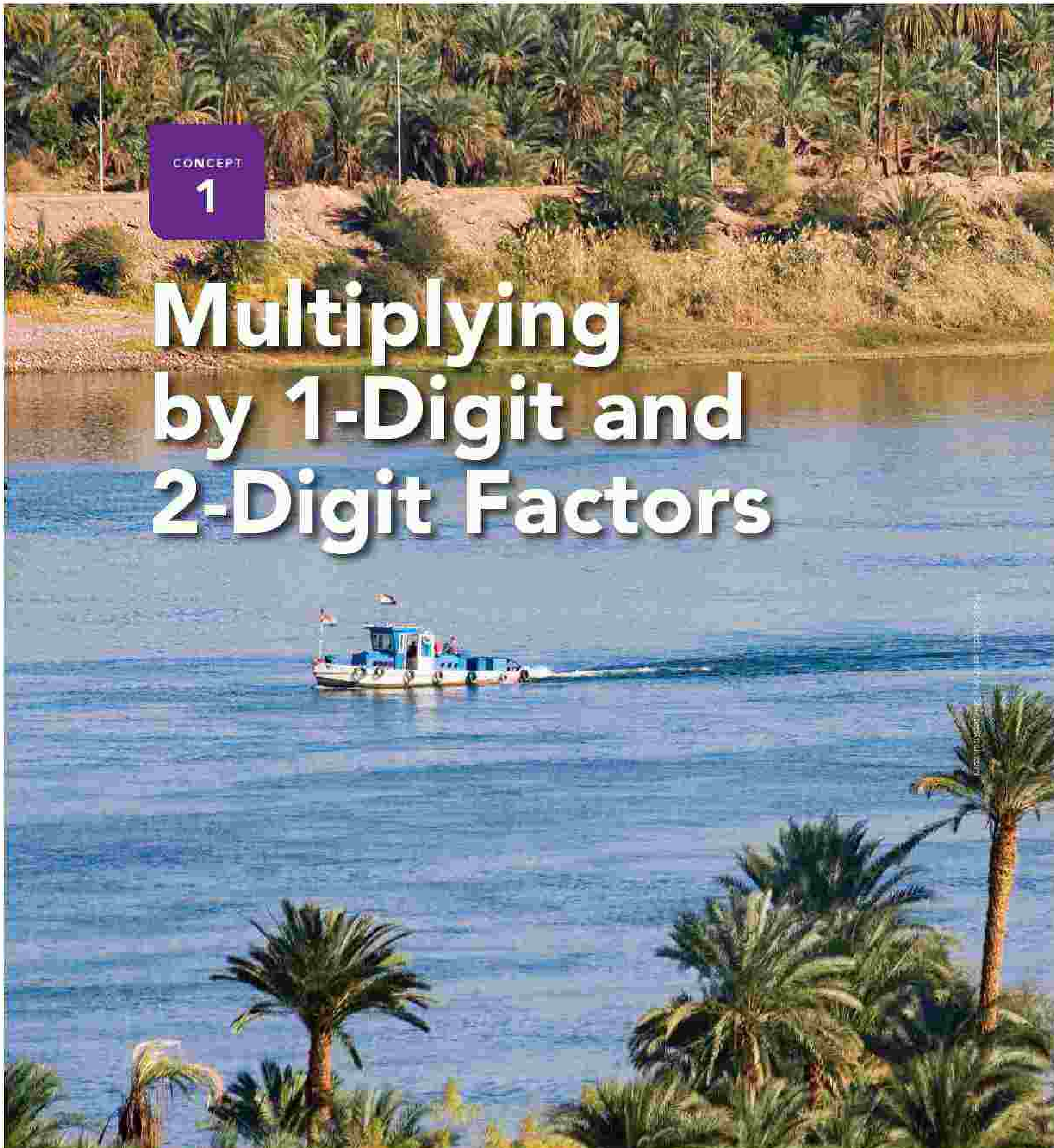
Solving Story Problems with the Four Operations

Students continue to use estimation to assess the reasonableness of an answer, but also learn to use the relationship between division and multiplication as a tool for checking the accuracy of answers. Students apply their learning in Unit 7 to solve multistep story problems involving addition, subtraction, multiplication, and division. In order to successfully solve story problems, students must first think about what is happening in the problem. Then, they must choose which operation is needed to solve. More than one operation is sometimes necessary. Students use the Three Reads strategy, which is designed to help students understand a problem by reading the problem a number of times, each time with a different intention. They read the problem once to understand what is happening in the problem, a second time to think about the numbers in the problem and what they might mean, and a third time to think about what question the problem could be asking. Students are also asked to think about math in their own worlds. It is important for students to see that math does not only happen in the classroom and that math is relevant to them and their own lives.



CONCEPT
1

Multiplying by 1-Digit and 2-Digit Factors



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Concept Overview

In Concept 1: Multiplying by One-Digit and Two-Digit Factors, students build on their learning in Primary 3 to deepen and extend their understanding of multiplication and improve their procedural fluency. They explore three different strategies for multiplying—the area model strategy, the partial products algorithm, and the standard algorithm. They apply their knowledge of place value, patterns when multiplying by multiples of 10, and multiplication facts to solve multiplication problems. Good mathematicians make connections between mathematical concepts and use those connections to solve problems. This concept encourages that practice.

Concept Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.A.2.b Multiply a whole number of up to four digits by a one-digit number using strategies based on place value and the properties of operations.

4.A.2.c Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

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Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 The Area Model Strategy	• Base Ten blocks (Optional)	Area model Decompose	• Students will use area models to represent two-digit by one-digit multiplication. • Students will explain how they use place value to multiply.	
2 The Distributive Property	• No additional materials needed	Area model Decompose Distributive Property of Multiplication	• Students will use an area model to multiply a one-digit number by a whole number with up to four digits. • Students will explain the Distributive Property of Multiplication. • Students will apply the Distributive Property of Multiplication to multiply a one-digit number by a whole number with up to four digits.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• While there are multiple ways to decompose a number, numbers should decompose using place value when using an area model for multiplication. For example, it is possible to decompose 23 in many different ways, including 17 and 6, 10 and 13, or 14 and 9. However, 23 should be decomposed into 20 and 3 when using an area model for multiplication. • Students may incorrectly decompose the factors according to their digits rather than according to the value of their digits. They may decompose 45 as 4 and 5 rather than 40 and 5.	Multiplying with the Area Model, Error Analysis, Practice, Check Your Understanding
	• While there are multiple ways to decompose a number, numbers should be decomposed using place value when using an area model for multiplication. It is possible to decompose 243 in many different ways. However, 243 should be decomposed into 200, 40, and 3 when using an area model for multiplication. • Students may get confused with how many zeros to place at the end of a product. For example, students may write 7 × 3,000 = 2,100 instead of 7 × 3,000 = 21,000. Students may also write 4 × 500 = 200 instead of 4 × 500 = 2,000.	Distributive Property and Area Models, Let's Try It, Making Connections, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
3 The Partial Products Algorithm	• No additional materials needed	Area model Distributive Property of Multiplication Algorithm Partial products algorithm	• Students will use the partial products algorithm to multiply a one-digit number by a whole number with up to four digits.	
4 The Standard Multiplication Algorithm	• No additional materials needed	Standard algorithm Distributive Property of Multiplication Area model Partial products	• Students will estimate products of multidigit multiplication problems. • Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.	
5 Review Connecting Strategies	• Lesson 5 Matching the Models Cards Sets A, B, and C (Photocopy the Blackline Master and have students work in groups of three. Each student in the group will get a different set of cards.) • Scissors	Review vocabulary as needed.	• Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.	
6 Two-Digit Multiplication	• No additional materials needed	Distributive Property of Multiplication	• Students will identify patterns when multiplying two multiples of 10. • Students will multiply a two-digit number by a multiple of 10. • Students will assess the reasonableness of an answer using estimation and mental math.	

	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may get confused with how many zeros to place at the end of a product. For example, students may write 7 × 3,000 = 2,100 instead of 7 × 3,000 = 21,000. Students may also write 4 × 500 = 200 instead of 4 × 500 = 2,000. • Students may line up the products incorrectly before adding to find their answer.	Partial Products, Fill in the Blanks, Error Analysis, Practice, Check Your Understanding
	• Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may omit writing the digit above the correct place or they may attempt to place two digits at a time in the product.	Using the Standard Algorithm, Writing About Math, Practice, Check Your Understanding
	• Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may forget to record their regrouped digit or attempt to place two digits in the product at once.	Can You Spot It?, Fix the Error, Writing About Math, Practice, Check Your Understanding
	• Students may have difficulty determining the number of zeros in a product when multiplying by multiples of 10, especially when the product of the basic fact ends in zero. For example, students may think that 80 × 50 = 400 rather than 4,000.	Ten Times, Multiplying by a Multiple of 10, Error Analysis, Practice, Check Your Understanding



Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
7 Area Models and Two-Digit Multiplication	• Lesson 7 Area Model Cards (Photocopy the Blackline Master; one set per student) • Scissors • Glue sticks	Review vocabulary as needed.	• Students will be able to use the area model to solve two-digit by two-digit multiplication problems.	
8 Algorithms and Two-Digit Multiplication	• No additional materials needed	Review vocabulary as needed.	• Students will apply a variety of strategies to solve two-digit by two-digit multiplication problems.	
9 Putting It All Together	• Lesson 9 Story Problem Cards (Photocopy the Blackline Master at the end of the volume; one card per student)	Review vocabulary as needed.	• Students will apply the Three Reads strategy to analyze and solve story problems. • Students will add, subtract, or multiply to solve story problems.	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to multiplying by one-digit and two-digit factors.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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Common Misconceptions and Errors	Opportunities for Formative Assessment
• Students may incorrectly decompose the factors in the problem, making it difficult for them to use the multiples of 10 to solve the problem. • Students may not multiply the correct numbers together, giving them an incorrect product.	Be the Teacher, Working with the Area Model, Writing About Math, Practice, Check Your Understanding
• Students may have difficulty decomposing numbers when a problem is written vertically. • Students may have a hard time keeping track of the partial products and how to distribute the numbers properly.	Let's Try the Standard Algorithm, Writing About Math, Practice, Check Your Understanding
• Students may solve part of a problem and think they are finished. Using strategies to thoroughly understand what is happening in a problem before solving is an important step in the problem-solving process. • Students who rely on key words may misinterpret what is happening in the problem. Using keywords in context is helpful in problem solving, but they are not a foolproof solution strategy.	Three Reads, Writing About Math, Practice, Check Your Understanding
• While there are multiple ways to decompose a number, numbers should be decomposed using place value when multiplying. • Students may incorrectly decompose the factors according to their digits rather than according to the value of their digits. • Students may have difficulty determining the number of zeros in a product when multiplying by multiples of 10, especially when the product of the basic fact ends in zero. • Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may forget to record their regrouped digit or attempt to place two digits in the product at once. • Students may have a hard time keeping track of the partial products and how to distribute the numbers properly.	

LESSON 1
The Area Model Strategy

Lesson Overview

In this lesson, students use their knowledge of place value and area models to develop an understanding of how to multiply two-digit numbers by one-digit numbers.

Lesson Essential Question

- How can we use our knowledge of place value to multiply and divide more efficiently?

Learning Objectives

In this lesson

- Students will use area models to represent two-digit by one-digit multiplication.
- Students will explain how they use place value to multiply.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit number using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

Vocabulary Check-In

area model, decompose

Materials List

- Base Ten blocks (optional)

Preparation

No additional preparation is required

DIGITAL



Lesson 1
The Area Model Strategy

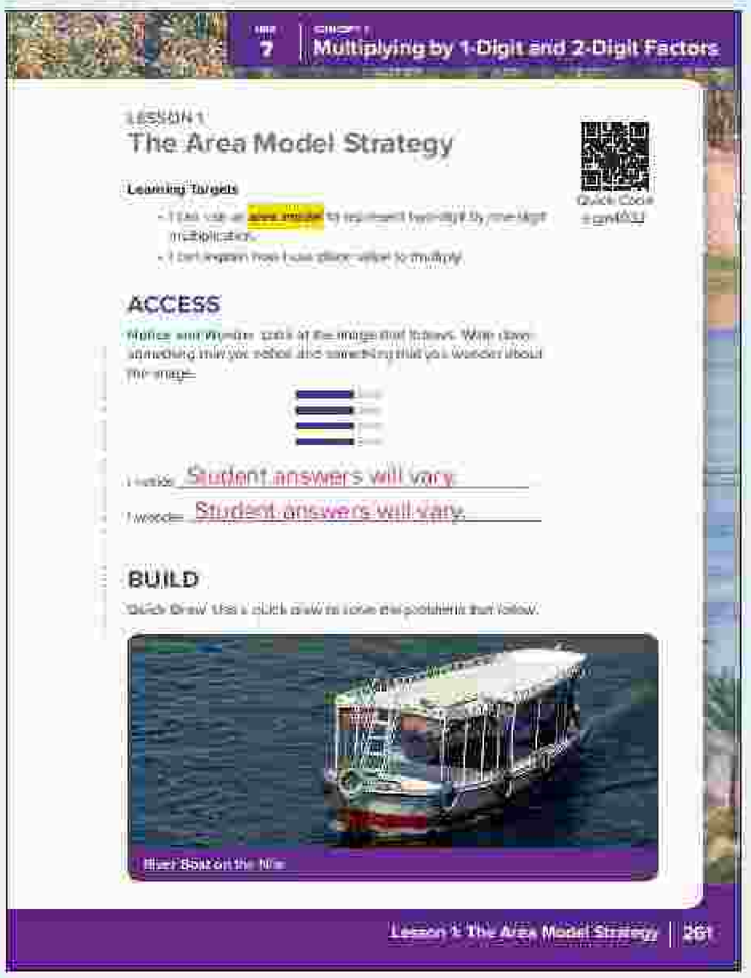
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PRINT

Student Page 261


7 | Multiplying by 1-Digit and 2-Digit Factors

LESSON 1

The Area Model Strategy

Learning Targets

ACCESS

Student answers will vary.

I wonder: Student answers will vary.

BUILD

River Boat on the Nile

Lesson 1: The Area Model Strategy | 261

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- While there are multiple ways to decompose a number, students should decompose numbers using place value when using the area model for multiplication. For example, it is possible to decompose 23 in many different ways including 17 and 6, 10 and 13, or 14 and 9. However, 23 should be decomposed into 20 and 3 when using an area model for multiplication.
- Students may incorrectly decompose the factors according to their digits rather than according to the value of their digits. They may decompose 45 as 4 and 5 rather than 40 and 5.

Notice and Wonder

1. Direct students to Lesson 1 ACCESS Notice and Wonder.
2. Ask students to look at the image and to write down what they notice and wonder. After 1 minute, ask students to share a few of their ideas.
3. Tell students that this image represents an array for the multiplication problem 4 × 13. Remind students that an array organizes objects into rows and columns.
4. Ask students where they see 4 in this image and where they see 13 in this image. Explain that this array uses Base Ten blocks to model the problem. Each rod represents 10 and that each square represents 1. Therefore, this array shows four rows with 13 in each row.

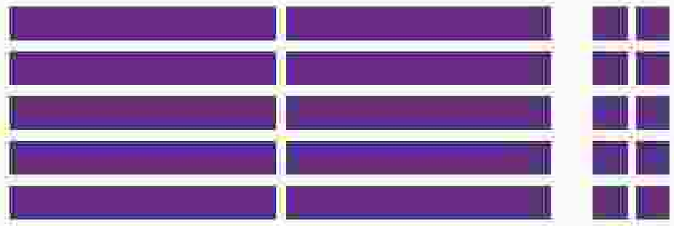
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BUILD (40 min)

Quick Draw (20 min)

1. Direct students to Lesson 1 BUILD Quick Draw. Ask a student to read Problem 1 aloud to the class. Explain that if the river bus holds 22 passengers and makes 5 trips, that means the bus holds 22 passengers 5 times, which tells us we can find the maximum number of passengers by solving 22 × 5.

2. Do a Think Aloud to model how to use Base Ten blocks to multiply 22 × 5. First, create an array using Base Ten blocks for 22 × 5. Place 2 Tens and 2 Ones in a row. Then, add 4 more rows of 22 so there are 5.



3. Begin finding the product of 22 × 5 by counting the blocks. Model counting the Tens (100) and then the Ones (10), then find the sum (110).

4. Share that sometimes a Quick Draw can be used instead of Base Ten blocks to solve a multiplication problem, especially when the numbers are small.

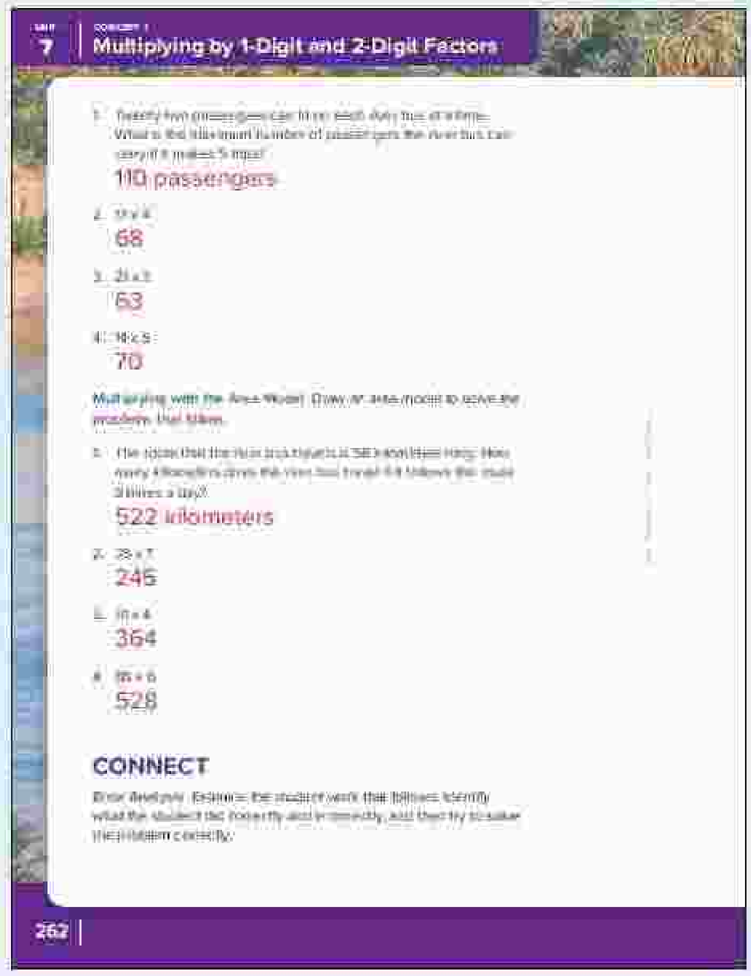
5. Model how to use a quick draw for 22 × 5. Draw two lines to represent the Tens and two dots to represent the Ones. (Note that we could draw small squares, but it would take longer.)



6. Ask students to describe how the Quick Draw array model is similar to the Base Ten block array model. Ask students to copy the array into their Student Edition.

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UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors

1. 110 passengers
2. 68
3. 63
4. 70

1. 522 kilometers
2. 245
3. 364
4. 528

CONNECT

262

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7. Direct students' attention to Problem 2. Ask students how they would show 17 if they had Base Ten blocks. Call on students to share their answers. Ask students to create a Quick Draw array to solve 17 × 4 (68). Ask a volunteer to draw their array on the board. Allow students to correct their work, if necessary.



8. If there is time left in the 20-minute segment, ask students to practice using Problems 3 and 4.

Multiplying with the Area Model (20 min)

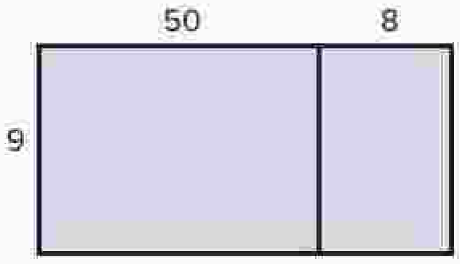
1. Write 58 × 9 on the board. Ask students to talk to their Shoulder Partner about how they would use a Quick Draw for 58 × 9. Encourage them to discuss what might be different about solving this problem. Students should notice that it would take a long time to draw 58 × 9 and that it may be difficult to count the Tens and Ones accurately. Explain that since these numbers are larger, it would not be efficient to use a Quick Draw array to solve.

2. Model how to draw an area model to visualize 58 × 9. Draw a rectangle that is longer than it is tall. Discuss how the sides of the rectangle represent each factor in the problem. (The short side represents 9 and the long side represents 58.)



3. Ask students the value of each digit in 58 (50 and 8). Explain that students have just decomposed this number using place value.

4. Split the rectangle into two parts by drawing a vertical line to represent how 58 was decomposed. Label the rectangle by writing 50 and 8 above each section of the rectangle and by writing 9 on the side.



5. Demonstrate multiplying the decomposed multiplication problem by writing and solving 50 × 9 and 8 × 9 and then adding the products 450 + 72 = 522.

	50	8	
9	50 × 9 = 450	8 × 9 = 72	450 + 72 = 522

6. Direct student to Lesson 1 ACCESS Multiplying with the Area Model and allow students to copy the area model for Problem 1. Work with students to solve Problems 2–4 (as time allows).

Answer Key for Multiplying with the Area Model:

1. 58 × 9 = 522 kilometers
2. 35 × 7 = 245

	30	5
7	30 × 7 = 210	5 × 7 = 35

210 + 35 = 245

3. 91 × 4 = 364

	90	1
4	90 × 4 = 360	1 × 4 = 4

360 + 4 = 364

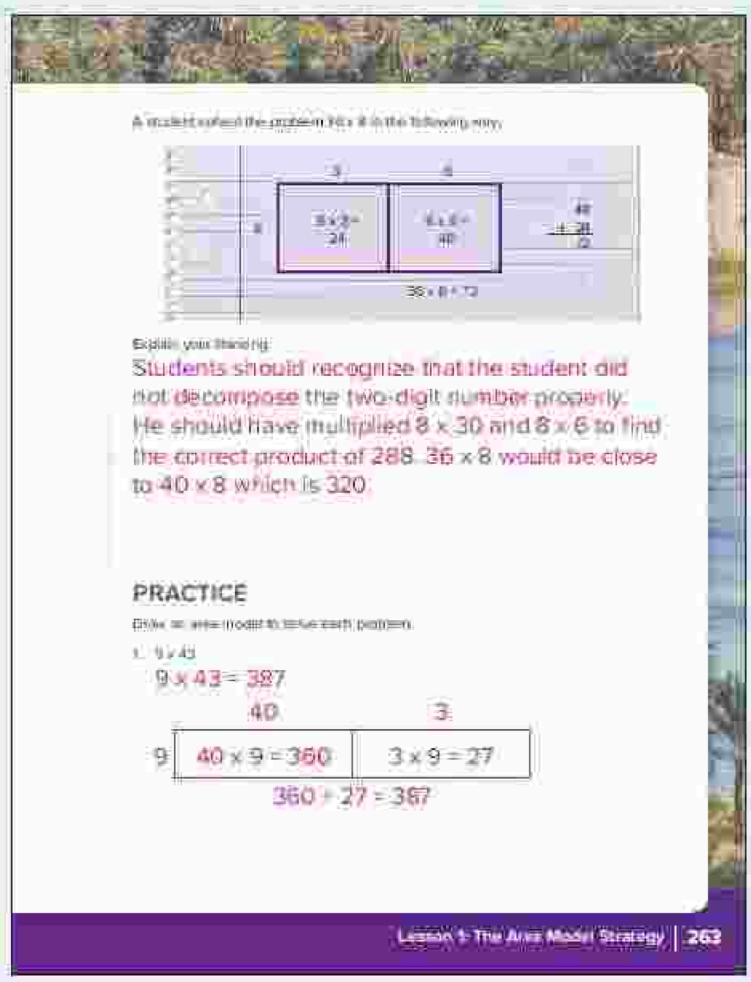
4. 88 × 6 = 528

	80	8
6	80 × 6 = 480	8 × 6 = 48

480 + 48 = 528

PRINT

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A student solved the problem 36 × 8 in the following way.

36 × 8 = 72

Explain your thinking.

Students should recognize that the student did not decompose the two-digit number properly. He should have multiplied 8 × 30 and 8 × 6 to find the correct product of 288. 36 × 8 would be close to 40 × 8 which is 320.

PRACTICE

Draw an area model to solve each problem.

1. 9 × 43

9 × 43 = 387

	40	3
9	40 × 9 = 360	3 × 9 = 27

360 + 27 = 387

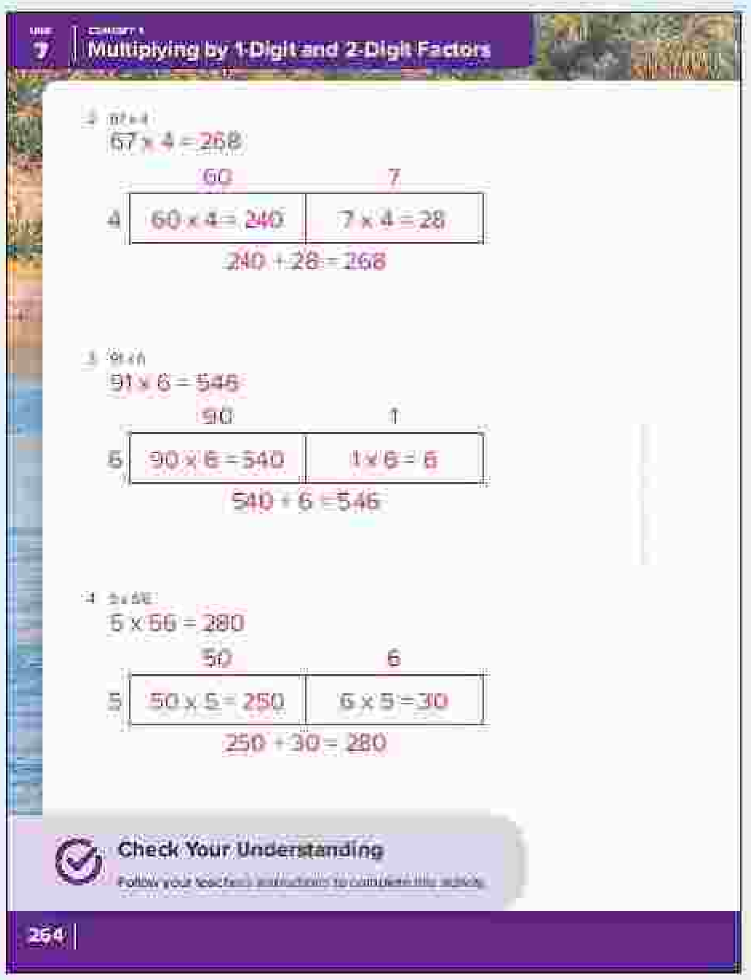
Lesson 1: The Area Model Strategy | 263

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7 | Multiplying by 1-Digit and 2-Digit Factors

2. 67 × 4

67 × 4 = 268

	60	7
4	60 × 4 = 240	7 × 4 = 28

240 + 28 = 268

3. 91 × 6

91 × 6 = 546

	90	1
6	90 × 6 = 540	1 × 6 = 6

540 + 6 = 546

4. 5 × 56

5 × 56 = 280

	50	6
5	50 × 5 = 250	6 × 5 = 30

250 + 30 = 280

Check Your Understanding

CONNECT (7 min)

Error Analysis

Direct students to Lesson 1 CONNECT Error Analysis. Ask students to review the work and answer, identify what the student did correctly and incorrectly, and try to solve the problem correctly.

TEACHER NOTE: Consider using this activity as a formative assessment to determine which students have an early understanding of multiplication using the area model.

Answer Key for Error Analysis:

1. The student did not decompose the two-digit number properly. He should have multiplied 8 × 30 and 8 × 6 to find the correct product of 288. 36 × 8 would be close to 40 × 8, which is 320.

WRAP-UP (3 min)

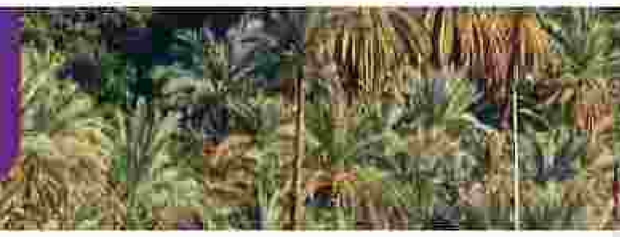
Let's Chat About Our Learning

Ask students to reflect on how they used place value in today's lesson. By the end of the discussion, make sure that students see that they used place value when decomposing two-digit factors, in multiplying the Tens and Ones in their models, and in regrouping Tens and Ones to find a product.

PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

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Check Your Understanding

Draw an area model to solve each problem.

1. 73 × 4 = 292

	70	3
4	70 × 4 = 280	3 × 4 = 12

280 + 12 = 292

2. 9 × 43 = 387

	40	3
9	40 × 9 = 360	3 × 9 = 27

360 + 27 = 387

3. 6 × 25 = 150

	20	5
6	20 × 6 = 120	5 × 6 = 30

120 + 30 = 150

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Materials List

No additional materials needed

Preparation

No additional preparation needed

LESSON 2
The Distributive Property

Lesson Overview

In this lesson, students continue to use area models to solve multidigit multiplication problems and further develop their understanding of the Distributive Property of Multiplication.

Lesson Essential Question

- How can we use our knowledge of place value to multiply and divide more efficiently?

Learning Objectives

In this lesson

- Students will use an area model to multiply a one-digit number by a whole number with up to four digits.
- Students will explain the Distributive Property of Multiplication.
- Students will apply the Distributive Property of Multiplication to multiply a one-digit number by a whole number with up to four digits.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit number using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

Vocabulary Check-In

area model, decompose, Distributive Property of Multiplication

DIGITAL



Lesson 2
The Distributive Property

Quick Code
egmt4033

ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

- While there are multiple ways to decompose a number, students should decompose numbers using place value when using the area model for multiplication. For example, it is possible to decompose 23 in many different ways including 17 and 6, 10 and 13, or 14 and 9. However, 23 should be decomposed into 20 and 3 when using an area model for multiplication.
- Students may get confused with how many zeros to place at the end of a product. For example, students may write $7 \times 3{,}000 = 2{,}100$ instead of $7 \times 3{,}000 = 21{,}000$. Students may also write $4 \times 500 = 200$ instead of $4 \times 500 = 2{,}000$.

Decomposing Numbers

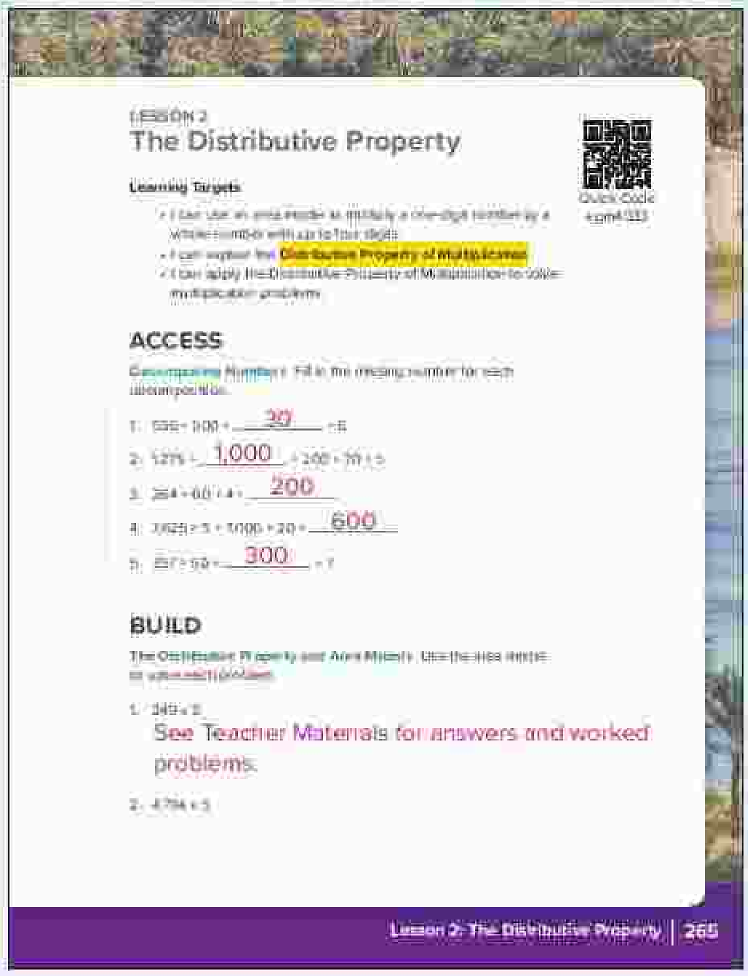
1. Direct students to Lesson 2 ACCESS Decomposing Numbers.
2. Ask students to fill in the blanks to decompose each number using place value.
3. When they are finished, read each problem aloud and instruct students to call out the answers when prompted.

Answer Key for Decomposing Numbers:

1. 536 = 500 + 30 + 6
2. 1,275 = 1,000 + 200 + 70 + 5
3. 264 = 60 + 4 + 200
4. 7,625 = 5 + 7,000 + 20 + 600
5. 357 = 50 + 300 + 7

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LESSON 2
The Distributive Property

Learning Targets

ACCESS

1. 30
2. 1,000
3. 200
4. 600
5. 300

BUILD

See Teacher Materials for answers and worked problems.

Lesson 2: The Distributive Property | 265



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Unit 7 | Concept 1
Multiplying by 1-Digit and 2-Digit Factors

[illegible]

	Problem	Numbers and Symbols	Area Model
1	[illegible]	See Teacher Materials for answers and worked problems	
2	[illegible]		
3	[illegible]		
4	[illegible]		

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BUILD (45 min)

The Distributive Property and Area Models (15 min)

1. Share with students that the reason numbers can be decomposed when multiplying is because of the Distributive Property of Multiplication.
2. Ask students for the root word in distributive (distribute). Ask a student to describe what it means to distribute something (to give shares of something or to give out).
3. Direct students to Lesson 2-BUILD The Distributive Property and Area Models where they will see the problem 249 × 5.
4. Ask students to turn to their Shoulder Partner and discuss how they think they could represent this problem using an area model.
5. Explain that since there is a three-digit number being multiplied by a one-digit number, their area model will have three sections.
6. Draw a long rectangle divided into three sections and explain that the larger number will be decomposed across the model. The 5 will be distributed across each part of 249.

7. Ask students to decompose 249 so that the value of each digit is represented. 200 + 40 + 9

   TEACHER NOTE Remind students that numbers can be decomposed in many different ways but it is most efficient to decompose by the value of each digit when using an area model.

8. Guide students through labeling the area model appropriately and solving the computations.
9. Repeat the process for Problem 2, which has a four-digit factor. Emphasize that the area model for this problem will have four sections to represent the value of each digit in the number.
10. Repeat the process for Problems 3 and 4 if there is time. Reinforce that the area model works because of the Distributive Property of Multiplication.

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Answer Key for The Distributive Property and Area Models:

1. 249 x 5 = 1,245

	200	40	9
5	200 x 5 = 1,000	40 x 5 = 200	9 x 5 = 45

249 x 5 = (200 x 5) + (40 x 5) + (9 x 5)
249 x 5 = 1,000 + 200 + 45 = 1,245
249 x 5 = 1,245

2. 4,734 x 5 = 23,670

	4,000	700	30	4
5	4,000 x 5 = 20,000	700 x 5 = 3,500	30 x 5 = 150	4 x 5 = 20

4,734 x 5 = (4,000 x 5) + (700 x 5) + (30 x 5) + (4 x 5)
4,734 x 5 = 20,000 + 3,500 + 150 + 20 = 23,670
4,734 x 5 = 23,670

3. 530 x 7 = 3,710

	500	30	
7	500 x 7 = 3,500	30 x 7 = 210	0 x 7 = 0

530 x 7 = (500 x 7) + (30 x 7) + (0 x 7 = 0)
530 x 7 = 3,500 + 210 + 0 = 3,710
530 x 7 = 3,710

4. 2,391 x 8 = 19,128

	2,000	300	90	1
8	2,000 x 8 = 16,000	300 x 8 = 2,400	90 x 8 = 720	1 x 8 = 8

2,391 x 8 = (2000 x 8) + (300 x 8) + (90 x 8) + (1 x 8)
2,391 x 8 = 16,000 + 2,400 + 720 + 8 = 19,128
2,391 x 8 = 19,128



Let's Try It (30 min)

1. Direct students to Lesson 2 BUILD Let's Try It.
2. Assign students to work in groups of three to solve the problems in their Student Edition. As students work, walk around and monitor their progress. Encourage students to draw area models if necessary.
3. With about five minutes left in BUILD, ask four volunteers to record their group's work on the board (each student should present the answer for one problem).

Answer Key for Let's Try It:

1. 32×7
   $(30 \times 7) + (2 \times 7)$
   $210 + 14 = 224$
   $32 \times 7 = 224$
2. 5×483
   $(400 \times 5) + (80 \times 5) + (3 \times 5)$
   $2{,}000 + 400 + 15 = 2{,}415$
   $5 \times 483 = 2{,}415$
3. 7×723
   $(700 \times 7) + (20 \times 7) + (3 \times 7)$
   $4{,}900 + 140 + 21 = 5{,}061$
   $7 \times 723 = 5{,}061$
4. $1{,}673 \times 8$
   $(1{,}000 \times 8) + (600 \times 8) + (70 \times 8) + (3 \times 8)$
   $8{,}000 + 4{,}800 + 560 + 24 = 13{,}384$

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CONNECT (7 min)

Making Connections

Direct students to Lesson 2 CONNECT Making Connections and ask them to solve the problem with an area model or with numbers and symbols.

Answer Key for Making Connections:

1,280 × 3

1,280 × 3 = (1,000 × 3) + (200 × 3) + (80 × 3) + (0 × 3)

1,280 × 3 = 3,000 + 600 + 240 + 0 = 3,840 centimeters

1,280 centimeters × 3 = 3,840 centimeters

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss the different strategies for solving multiplication problems. Which strategy do they find more effective? Why? What questions do they still have about using the strategies to multiply?

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CONNECT

Making Connections: Read the problem. Solve using an area model or using numbers and symbols. Be prepared to share your thinking.



Bus in the Desert

A city bus is 1,280 centimeters long. What is the length of 3 city buses?

3,840 centimeters

PRACTICE

Use an area model to solve the following equations.

1. 78 × 4

78 × 4 = 312

	70	8
4	70 × 4 = 280	8 × 4 = 32

280 + 32 = 312

2. 4 × 594

4 × 594 = 2,376

	500	90	4
4	500 × 4 = 2,000	90 × 4 = 360	4 × 4 = 16

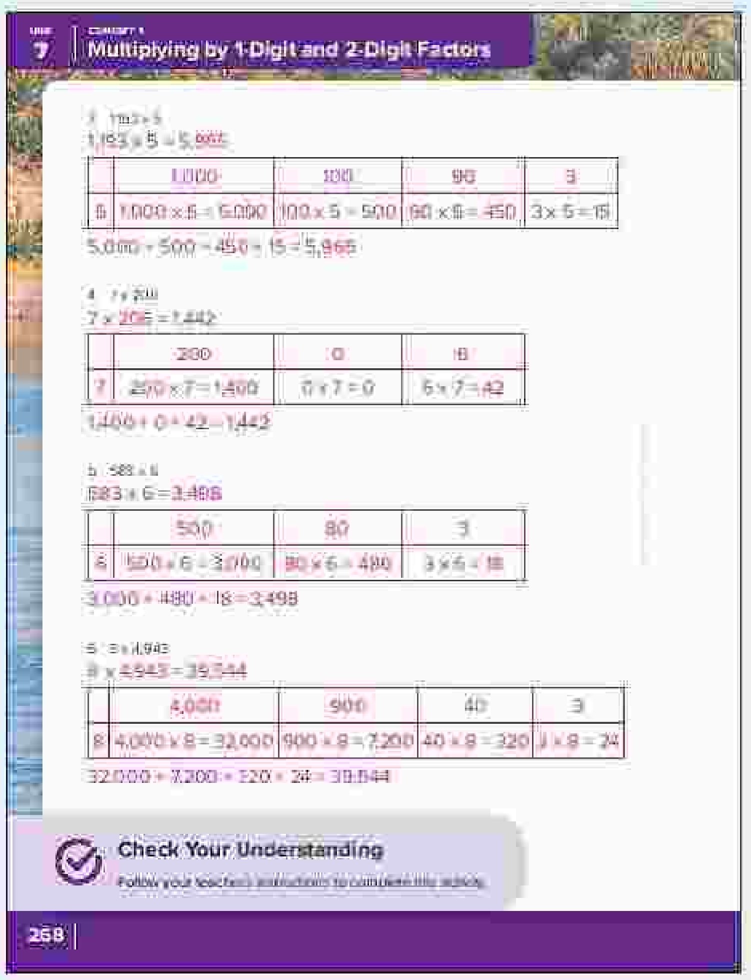
2,000 + 360 + 16 = 2,376

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Unit 7 | Concept 1

Multiplying by 1-Digit and 2-Digit Factors

3. 1,193 × 5

1,193 × 5 = 5,965

	1,000	100	90	3
5	1,000 × 5 = 5,000	100 × 5 = 500	90 × 5 = 450	3 × 5 = 15

5,000 + 500 + 450 + 15 = 5,965

4. 7 × 206

7 × 206 = 1,442

	200	0	6
7	200 × 7 = 1,400	0 × 7 = 0	6 × 7 = 42

1,400 + 0 + 42 = 1,442

5. 583 × 6

583 × 6 = 3,498

	500	80	3
6	500 × 6 = 3,000	80 × 6 = 480	3 × 6 = 18

3,000 + 480 + 18 = 3,498

6. 8 × 4,943

8 × 4,943 = 39,544

	4,000	900	40	3
8	4,000 × 8 = 32,000	900 × 8 = 7,200	40 × 8 = 320	3 × 8 = 24

32,000 + 7,200 + 320 + 24 = 39,544

Check Your Understanding

Follow your teacher's instructions to complete this activity.

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PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Use an area model or numbers and symbols to solve the following equations.

1. 548 × 3 = 1,644
   (500 × 3) + (40 × 3) + (8 × 3)
   1,500 + 120 + 24 = 1,644

2. 6 × 38 = 228
   (30 × 6) + (8 × 6)
   180 + 48 = 228

3. Look at the area model. Describe where and how you see the Distributive Property being used.

	300	70	4
6	300 × 6 = 1800	70 × 6 = 420	4 × 6 = 24

1800 + 420 + 24 = 2244

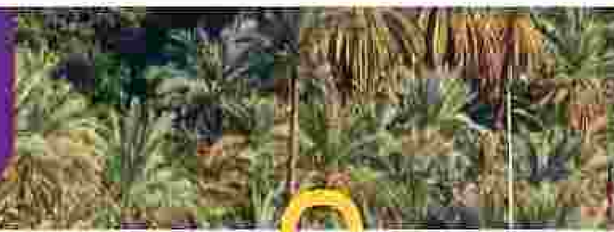
In this problem, the 6 is being distributed to each part of 374. So, 374 × 6 is the same as (300 × 6) + (70 × 6) + (4 × 6).

4. Laila solved 328 × 4 using numbers and symbols. Describe her error and fix her mistake.

   328 × 4
   = (300 + 20 + 8) × 4
   = (300 + 4) + (20 + 4) + (8 + 4)
   = 304 + 24 + 12
   = 336

   Laila added when she distributed the 4. She should have multiplied by 4. (300 × 4) + (20 × 4) + (8 × 4) = 1,200 + 80 + 32 = 1,312

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LESSON 3
The Partial Products Algorithm

Lesson Overview

In this lesson, students build on their understanding of multidigit multiplication and learn the partial products algorithm.

Lesson Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will use the partial products algorithm to multiply a one-digit number by a whole number with up to four digits.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit number using strategies based on place value and the properties of operations.

Vocabulary Check-In

area model, distributive property of multiplication, algorithm, partial products algorithm

Materials List

No additional materials needed

Preparation

No preparation needed

DIGITAL



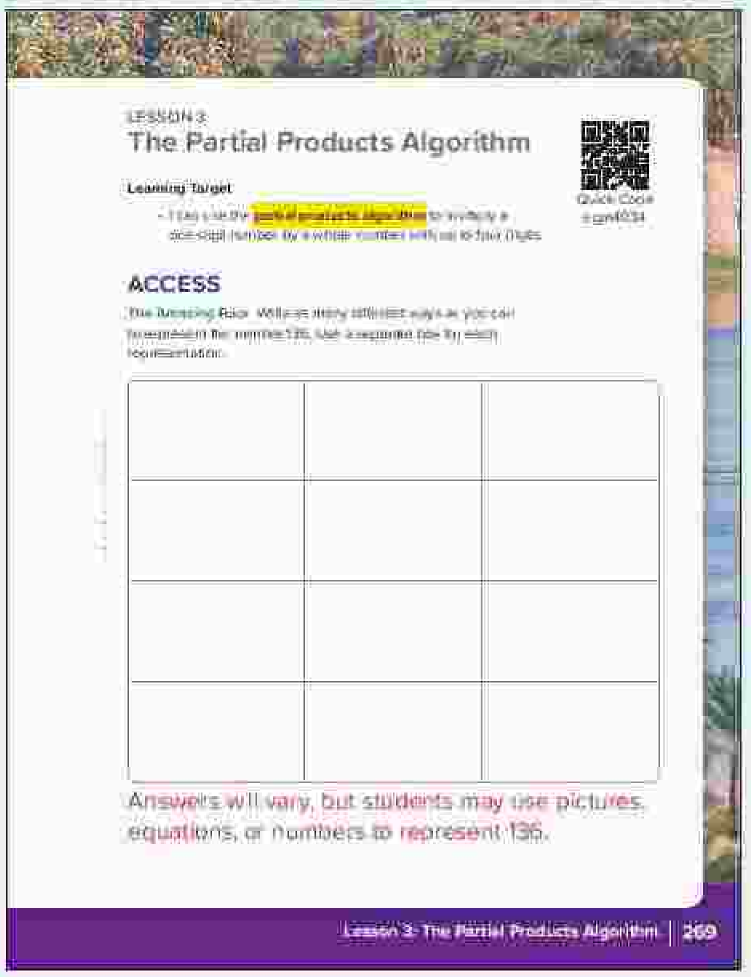
Lesson 3
The Partial Products Algorithm

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LESSON 3

The Partial Products Algorithm

Learning Target

- I can use the partial products algorithm to multiply a one-digit number by a whole number with up to four digits.

Quick Code

ACCESS

The Amazing Race: Write as many different ways as you can to represent the number 136. Use a separate box for each representation.

Answers will vary, but students may use pictures, equations, or numbers to represent 136.

Lesson 3: The Partial Products Algorithm | 269

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may get confused with how many zeros to place at the end of a product. For example, students may write $7 \times 3{,}000 = 2{,}100$ instead of $7 \times 3{,}000 = 21{,}000$. Students may also write $4 \times 500 = 200$ instead of $4 \times 500 = 2{,}000$.
- Students may line up the products incorrectly before adding to find their answer.

The Amazing Race

1. Explain to students that they will practice representing and decomposing numbers in different ways. Remind students that although they have been decomposing numbers according to place value in order to multiply, mathematicians need to be able to represent and decompose numbers in different ways.

2. Ask students to help you decompose the number 74. Encourage students to think of several ways to decompose the number. Record students' ideas on the board.

   TEACHER NOTE: This is an opportunity to address common misconceptions by offering an incorrect decomposition and allowing students to discuss whether or not that is correct (for example: 4 Tens and 7 Ones or 7 + 4). Also, in preparation for students to work on this independently, provide creative examples to represent 74 (for example: 6 Tens and 14 Ones or 74 Ones).

3. Direct students to Lesson 3 ACCESS The Amazing Race. Explain to students that they will have three minutes to fill in as many of the boxes as they can with different representations of a number.

4. After three minutes, ask students to share their answers. Record their work on the board and encourage students to add new answers to their grids.

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BUILD (40 min)

Partial Products (30 min)

1. Share that mathematicians often use procedures or a set of steps called an algorithm to help them to solve math problems. Today students will learn the partial products algorithm for multiplication.
2. Direct students to Lesson 3 BUILD Partial Products and ask students to solve the problem using the area model. Ask a student to draw their area model on the board.

	700	30	1
4	$700 \times 4 = 2{,}800$	$30 \times 4 = 120$	$1 \times 4 = 4$

$2{,}800 + 120 + 4 = 2{,}924$

3. Model using the partial products algorithm to solve 731×4. Remind students that digits in the same place in numbers must be lined up properly when adding.

$$\begin{array}{rl} 731 & \\ \times\ \ 4 & \\ \hline 2{,}800 & (700 \times 4) \\ 120 & (30 \times 4) \\ +\ \ 4 & (1 \times 4) \\ \hline 2{,}924 & \end{array}$$

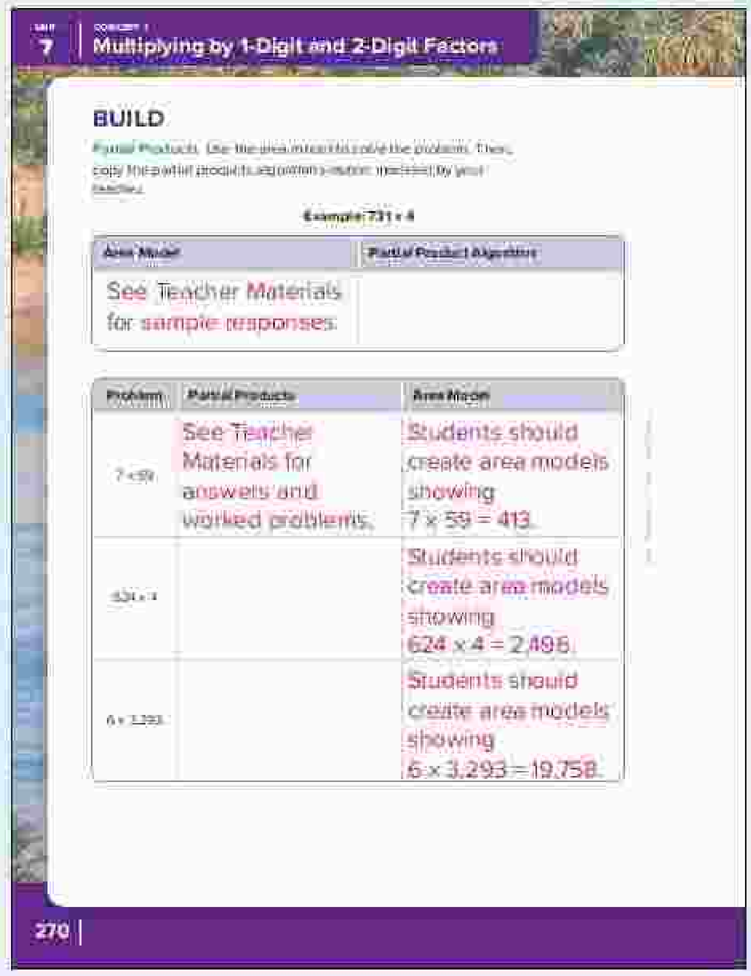
TEACHER NOTE: Throughout the Answer Keys, you will see that the order of factors in the partial products problems changes. Students should recognize that the Commutative Property of Multiplication allows us to write the factors in any order. However, it is recommended that, within a single problem, student maintain the same order to help them organize their thinking and work.

4. Ask students to discuss with a partner the similarities and differences between the partial products algorithm and the multiplication strategies they have learned.

Students should recognize that the larger factor is still decomposed and that the products are the same. However, the problem is set up vertically and there are no boxes.

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UNIT 7 | CONCEPT 1 Multiplying by 1-Digit and 2-Digit Factors

BUILD

Example: 731 × 4

Area Model	Partial Product Algorithm
See Teacher Materials for sample responses.	

Problem	Partial Products	Area Model
7 × 59	See Teacher Materials for answers and worked problems.	Students should create area models showing 7 × 59 = 413.
624 × 4		Students should create area models showing 624 × 4 = 2,496.
6 × 3,293		Students should create area models showing 6 × 3,293 = 19,758.

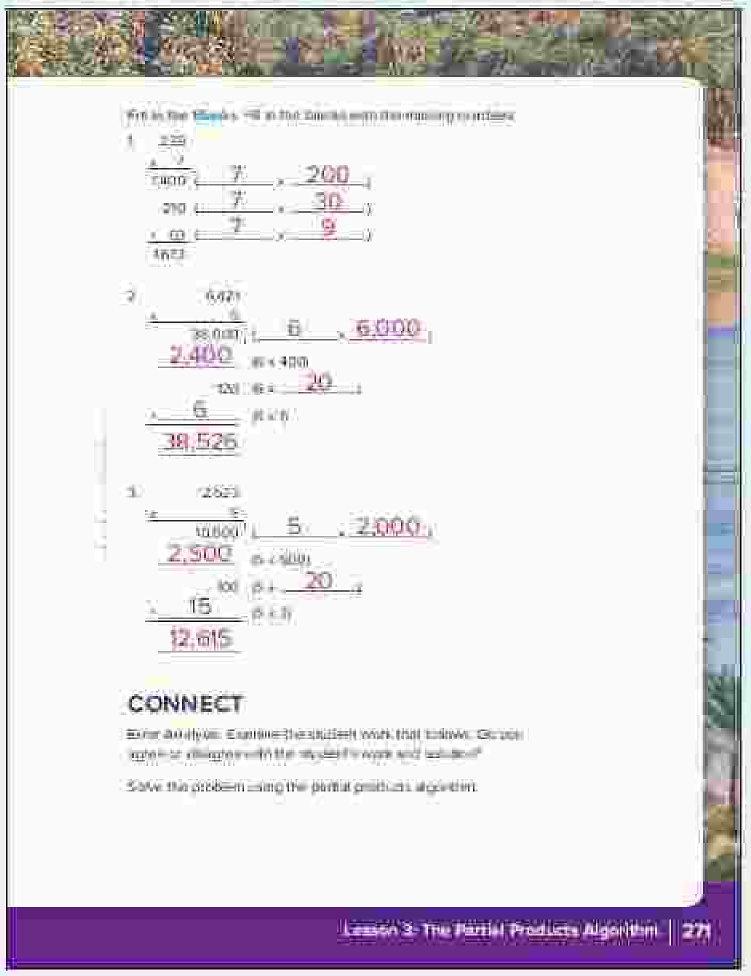
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Fill in the Blanks

1. 7 × 200, 7 × 30, 7 × 9

2. 6,421 × 6: 36,000 (6 × 6,000), 2,400 (6 × 400), 120 (6 × 20), + 6 (6 × 1), 38,526

3. 2,523 × 5: 10,000 (5 × 2,000), 2,500 (5 × 500), 100 (5 × 20), + 15 (5 × 3), 12,615

CONNECT

Solve the problem using the partial products algorithm.

Lesson 3: The Partial Products Algorithm | 271

5. Ask students to copy the partial products example into their Student Editions.

   TEACHER NOTE: The number of calculations when using the partial products algorithm is the same as the area model. Challenge students' thinking by asking them to predict how many partial products will result from a five-digit by one-digit multiplication problem.

6. Guide students through the additional problems reminding them to line up the products carefully according to place value.

Answer Key for Partial Products:

1. 7 × 59 = 413

```
   59
×   7
  350 (50 × 7)
+  63 (9 × 7)
  413
```

2. 624 × 4 = 2,496

```
    624
×     4
  2,400 (600 × 4)
     80 (20 × 4)
+    16 (4 × 4)
  2,496
```

3. 6 × 3,293 = 19,758

```
   3,293
×      6
  18,000 (3,000 × 6)
   1,200 (200 × 6)
     540 (90 × 6)
+     18 (3 × 6)
  19,758
```

Fill in the Blanks (10 min)

1. Direct students to Lesson 3 BUILD Fill in the Blanks. Go over the directions together and ask students to solve the problems.

2. At the end of BUILD, go over the answers with students.

Answer Key for Fill in the Blanks:

1.
```
   239
×    7
 1,400 (7 × 200)
   210 (7 × 30)
+   63 (7 × 9)
 1,673
```

2.
```
   6,421
×      6
  36,000 (6 × 6,000)
   2,400 (6 × 400)
     120 (6 × 20)
+      6 (6 × 1)
  38,526
```

3
```
   2,523
×      5
  10,000 (5 × 2,000)
   2,500 (5 × 500)
     100 (5 × 100)
+     15 (5 × 3)
  12,615
```

CONNECT (7 min)

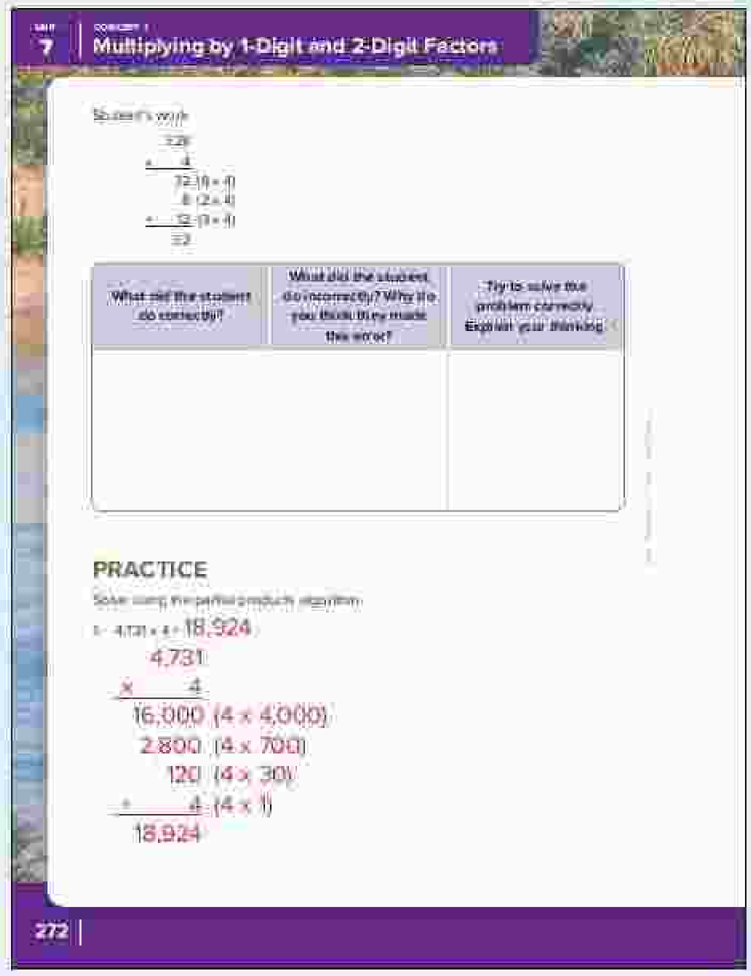
Error Analysis

Ask students to turn to Lesson 3 CONNECT Error Analysis to complete the error analysis activity.
The student tried to multiply each number by 4, but forgot about place value. 2 should be 20 and 3 should be 300. The correct answer is 1,312.

TEACHER NOTE: This activity can be used as a formative assessment to help you determine which students may need additional support and practice.

PRINT

Student Page 272


UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors

Student's work
```
  328
×   4
   32 (8 × 4)
    8 (2 × 4)
+  12 (3 × 4)
   52
```

What did the student do correctly?	What did the student do incorrectly? Why do you think they made this error?	Try to solve the problem correctly. Explain your thinking.

PRACTICE

Solve using the partial products algorithm.

1. 4,731 × 4 = 18,924
```
   4,731
×      4
  16,000 (4 × 4,000)
   2,800 (4 × 700)
     120 (4 × 30)
+      4 (4 × 1)
  18,924
```

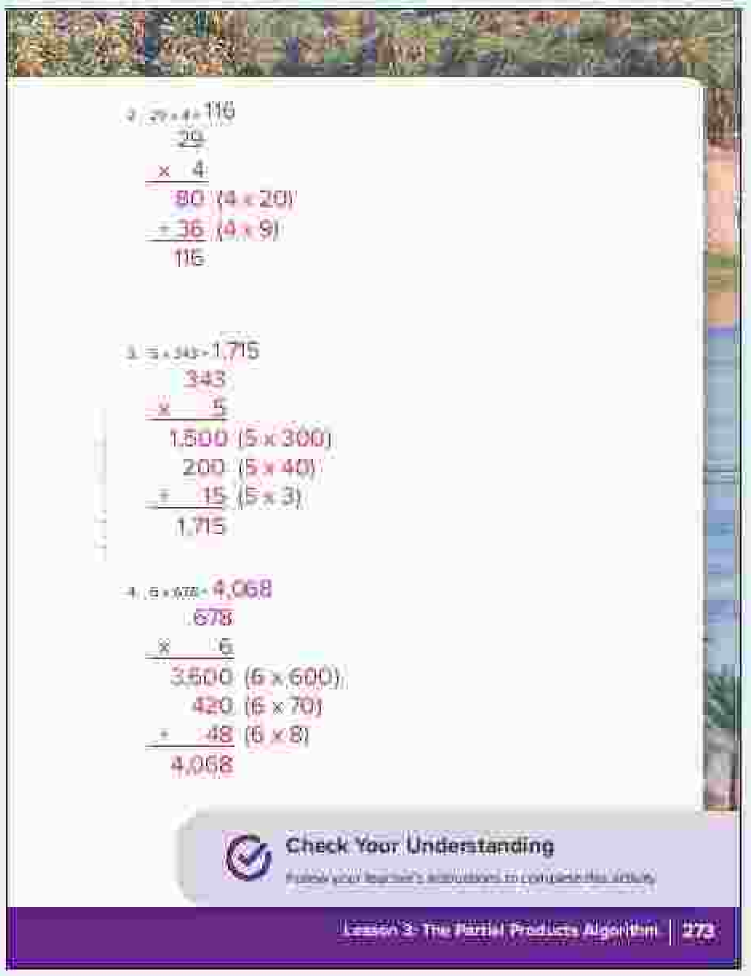
272

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2. 29 × 4 = 116

```
    29
×    4
    80 (4 × 20)
+   36 (4 × 9)
   116
```

3. 5 × 343 = 1,715

```
    343
×     5
  1,500 (5 × 300)
    200 (5 × 40)
+    15 (5 × 3)
  1,715
```

4. 6 × 678 = 4,068

```
    678
×     6
  3,600 (6 × 600)
    420 (6 × 70)
+    48 (6 × 8)
  4,068
```

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 3: The Partial Products Algorithm | 273

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to reflect on why they think this algorithm is called "partial products."
Each calculation is "part" of the bigger product.

PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the partial products algorithm. Show your work.

1. 4 × 476 = 1,904

```
    476
×     4
  1,600 (400 × 4)
    280 (70 × 4)
+    24 (6 × 4)
  1,904
```

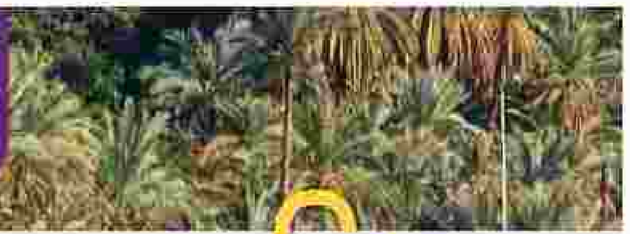
2. 58 × 6 = 348

```
    58
×    6
   300 (50 × 6)
+   48 (8 × 6)
   348
```

Solve using any method. Show your work.

3. 301 × 3 = 903

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LESSON 4
The Standard Multiplication Algorithm

Lesson Overview

In this lesson, students are introduced to the standard algorithm for multiplication. They connect the steps of the standard algorithm with what they have previously learned about area models and the partial product algorithm.

Lesson Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will estimate products of multidigit multiplication problems.
- Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

4.C.1.a Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

standard algorithm, Distributive Property of Multiplication, area model, partial products

Materials List

No additional materials needed

Preparation

No additional preparation needed

DIGITAL



Lesson 4
The Standard Multiplication Algorithm

Quick Code: egmt4035



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Multiplying by 1-Digit and 2-Digit Factors

LESSON 4

The Standard Multiplication Algorithm

Learning Targets

- I can estimate products.
- I can use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.

ACCESS

Similarities in Models. Estimate the products of the two problems. Then, solve using the method assigned by your teacher.

Estimate:

Solved Answer:

See Teacher Materials for answers and worked problems.

BUILD

Using the Standard Algorithm. Estimate the product for Problems 3–6. Then, solve using the standard algorithm. Multiply using another strategy to help you, if necessary.

Cars on a Bridge

274

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may omit writing the digit above the correct place or they may attempt to place two digits at a time in the product.

Similarities in Models

1. Direct students to Lesson 4 ACCESS Similarities in Models. Ask students to estimate the products of the two problems. Remind students that rounding is one way to estimate.
2. Split the class in half to solve the problem. Assign half of the class to solve the two problems with an area model and half of the class to solve the two problems using partial products. Encourage students to work together and to agree on an answer.
3. Ask a student in each group to record their work on the board and compare their answers with the estimates. Both estimates will be low because they rounded down. Students will refer to this again later in the lesson.

Answer Key for Similarities in Models:

1. Possible estimate: $60 \times 7 = 420$

	60	4
7	$60 \times 7 = 420$	$4 \times 7 = 28$

$420 + 28 = 448$

$$\begin{array}{rl} 64 & \\ \times\ 7 & \\ \hline 420 & (60 \times 7) \\ +\ 28 & (4 \times 7) \\ \hline 448 & \end{array}$$

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2 Possible estimates: $100 \times 8 = 800$ or $130 \times 8 = 1{,}040$

	100	30	2
8	$100 \times 8 = 800$	$30 \times 8 = 240$	$2 \times 8 = 16$

$800 + 240 + 16 = 1{,}056$

$$
\begin{array}{r l}
132 & \\
\times \quad 8 & \\
\hline
800 & (100 \times 8) \\
240 & (30 \times 8) \\
+ \quad 16 & (2 \times 8) \\
\hline
1{,}056 &
\end{array}
$$

BUILD (40 min)

Using the Standard Algorithm

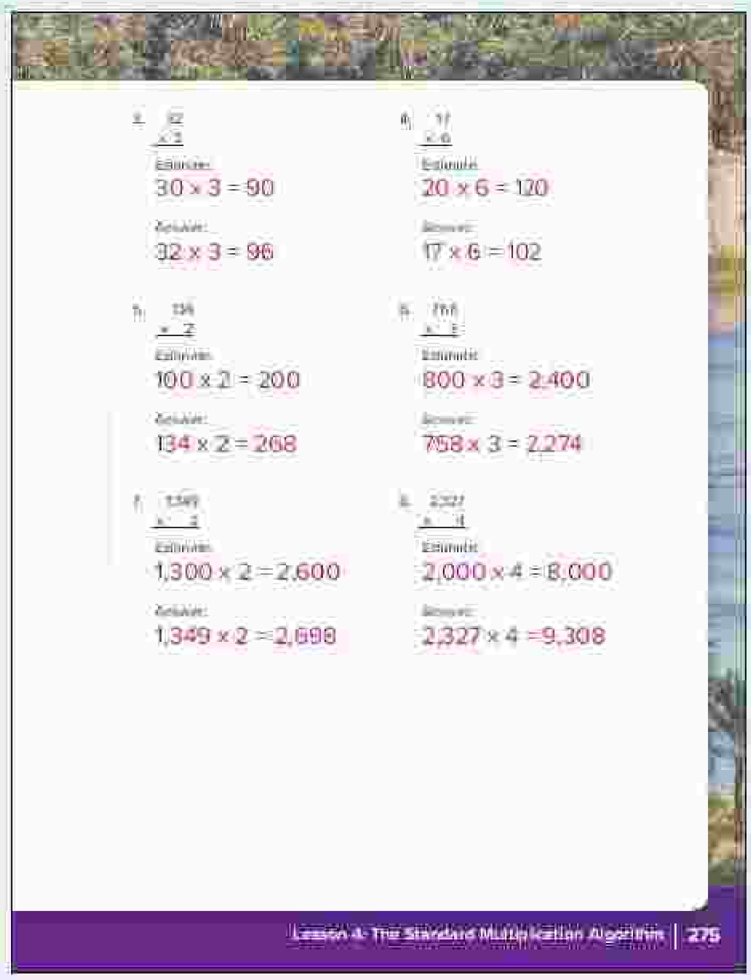
1. Explain to students that today they will be learning the standard algorithm for multiplication. The strategies they have been using are effective and will help them find the correct product, but they can take a long time to solve. The standard algorithm is the most efficient strategy for multiplication. Assure students they may continue to use the strategies they are comfortable with while they are practicing the standard algorithm. Students are likely to need additional practice to master this skill.

2. Write 64×7 vertically on the board. Remind students that since they already know the correct product, they can focus on making connections as they watch the steps of the standard algorithm.

3. Model using the standard algorithm to solve 64×7. Students should refer to the area model to answer the multiplication.
   - Line up the numbers vertically with the larger number on top.
   - Point out to students where the Ones and Tens places are.
   - Start multiplying the Ones place (7 Ones × 4 Ones = 28 Ones).
   - Explain to students that since 28 Ones is 2 Tens and 8 Ones, they will need to regroup. Just as with addition and subtraction, regrouping with multiplication is when they group 10 Ones into 1 Ten. In this case, put the 8 Ones beneath

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Estimate: $30 \times 3 = 90$
Answer: $32 \times 3 = 96$

Estimate: $20 \times 6 = 120$
Answer: $17 \times 6 = 102$

Estimate: $100 \times 2 = 200$
Answer: $134 \times 2 = 268$

Estimate: $800 \times 3 = 2{,}400$
Answer: $758 \times 3 = 2{,}274$

Estimate: $1{,}300 \times 2 = 2{,}600$
Answer: $1{,}349 \times 2 = 2{,}698$

Estimate: $2{,}000 \times 4 = 8{,}000$
Answer: $2{,}327 \times 4 = 9{,}308$

Lesson 4: The Standard Multiplication Algorithm | 275



the line in the Ones place, but the 2 Tens will go above 6 in the Tens place. This means they regrouped 20 Ones for 2 Tens.

- Next, multiply the Tens (7 Ones × 6 Tens = 42 Tens).
- Explain to students that they need to add the 2 Tens from the previous step (42 Tens + 2 Tens = 44 Tens).
- Explain to students that since 44 Tens is 4 Hundreds and 4 Tens, they will need to regroup. Write the 4 Tens beneath the line in the Tens place then write the 4 Hundreds in the Hundreds place.
- Read the problem with the product to students: 64 × 7 = 448. Ask students if this matches what they got when solving with the other two strategies.

$$\begin{array}{r} {}^{2} \\ 64 \\ \times\ \ 7 \\ \hline 8 \\ +\,440 \\ \hline 448 \end{array}$$

4. Ask students to think about the similarities between the standard algorithm and the area model and the partial products algorithm as they copy your work into their Student Edition. Allow students to share their thinking with their Shoulder Partner.

5. Next, model using the standard algorithm to solve 132 × 8. Again, remind students that they already know the correct product, so they can focus on making connections as they watch the steps of the standard algorithm. Use the following steps as you model. Students should refer to the area model to answer the multiplication.

   a. Line up the numbers vertically with the larger number on top.

   b. Start multiplying the Ones (8 Ones × 2 Ones = 16 Ones).

   c. Write the digit 6 in the Ones place underneath the line. Write the digit 1 representing 1 Ten above the digit 3. Remind students that this is called regrouping.

   d. Next, multiply the Tens (8 Ones × 3 Tens = 24 Tens).

   e. Add 1 Ten (from the previous step) to 24 Tens to get 25 Tens. Write the digit 5 in the Tens place underneath the line. Regroup by writing the digit 2 representing 2 Hundreds above the digit 2 in the Hundreds place.

   f. Finally, multiply the Hundreds (8 Ones × 1 Hundreds = 8 Hundreds).

   g. Add 2 Hundreds (from the previous step) plus 8 Hundreds to get 10 Hundreds. Remind students that 10 Hundreds is 1 Thousand. Write 0 in the Hundreds place and 1 in the Thousands place underneath the line.

$$\begin{array}{r} {}^{2\,1} \\ 132 \\ \times\ \ \ \ 8 \\ \hline 6 \\ 50 \\ +\ 1{,}000 \\ \hline 1{,}056 \end{array}$$

6. Ask students to think about the similarities between the standard algorithm and the area model and the partial products algorithm while they copy the problem in Lesson 4 BUILD Using the Standard Algorithm. Allow students to share their thinking with their Shoulder Partner.

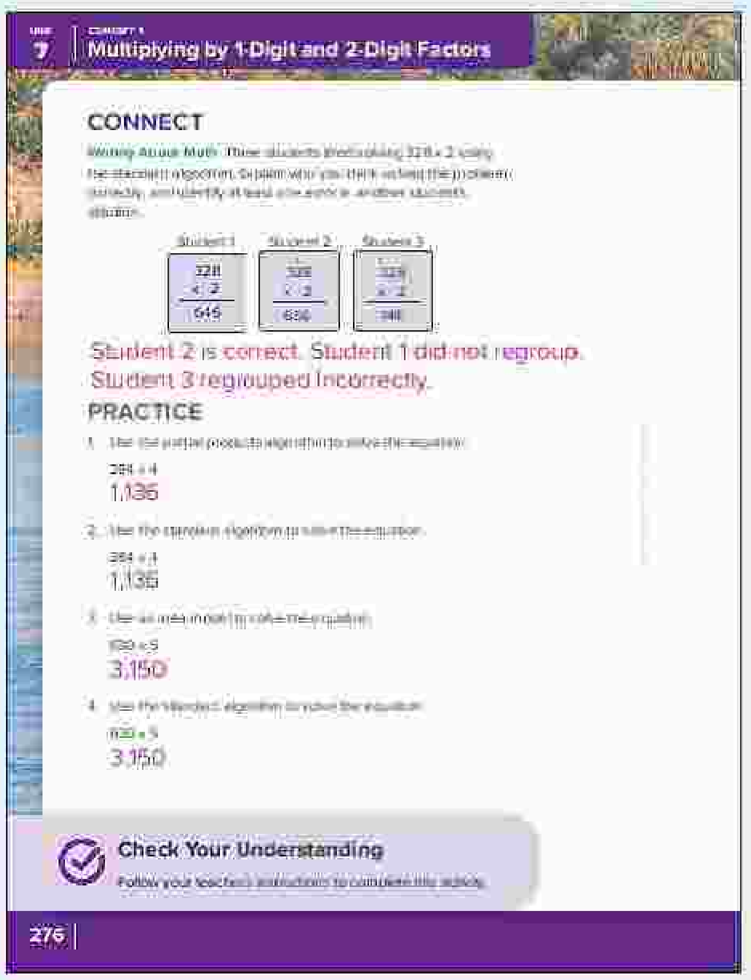
7. Instruct students to estimate before trying to solve the rest of the problems using the standard algorithm. Remind them to compare their answers with their estimates. If students have difficulty getting started, encourage them to use another strategy to multiply to help them find the correct answer using the standard algorithm. Note that it is not important that students estimate the same way, but they should get the same answer using the standard algorithm.

8. As students are working, circulate around the room. If students are struggling, work through a few of the problems together on the board. After students finish, ask students to share out answers and discuss how they used the standard algorithm to solve.



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Student Page 276



7 Multiplying by 1-Digit and 2-Digit Factors

CONNECT

Student 2 is correct. Student 1 did not regroup. Student 3 regrouped incorrectly.

PRACTICE

1. 1,136
2. 1,136
3. 3,150
4. 3,150

Check Your Understanding

276

CONNECT (7 min)

Writing About Math

1. Ask students to turn to Lesson 4 CONNECT Writing About Math and respond to the prompt.

Student 1	Student 2	Student 3
328 × 2 646	1 328 × 2 656	1 328 × 2 746

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their lingering questions related to the standard algorithm. Encourage students to answer each other's questions when possible.

PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. Solve 471 × 3 using partial product or area model.

$$\begin{array}{r} 471 \\ \times \quad 3 \\ \hline 1{,}200\ (400 \times 3) \\ 210\ (70 \times 3) \\ +\quad 3\ (1 \times 3) \\ \hline 1{,}413 \end{array}$$

	400	70	1
3	400 × 3 = 1,200	70 × 3 = 210	1 × 3 = 3

1,200 + 210 + 3 = 1,413

2. Solve 471 × 3 using standard algorithm.

$$\begin{array}{r} 471 \\ \times \quad 3 \\ \hline 3 \\ 210 \\ +\ 1{,}200 \\ \hline 1{,}413 \end{array}$$

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LESSON 5
Review Connecting Strategies

Lesson Overview

In this lesson, students continue to build fluency using the standard algorithm for multiplication.

Lesson Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.

Grade-Level Standards

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Unit 7 Lesson 5 Matching the Models Cards Sets A, B, and C (1 set per student)
- Scissors

Preparation

Photocopy the Blackline Master at the end of the volume. Students will work in groups of three. Each student in the group will get a different set of cards.

DIGITAL



Lesson 5
Review Connecting Strategies

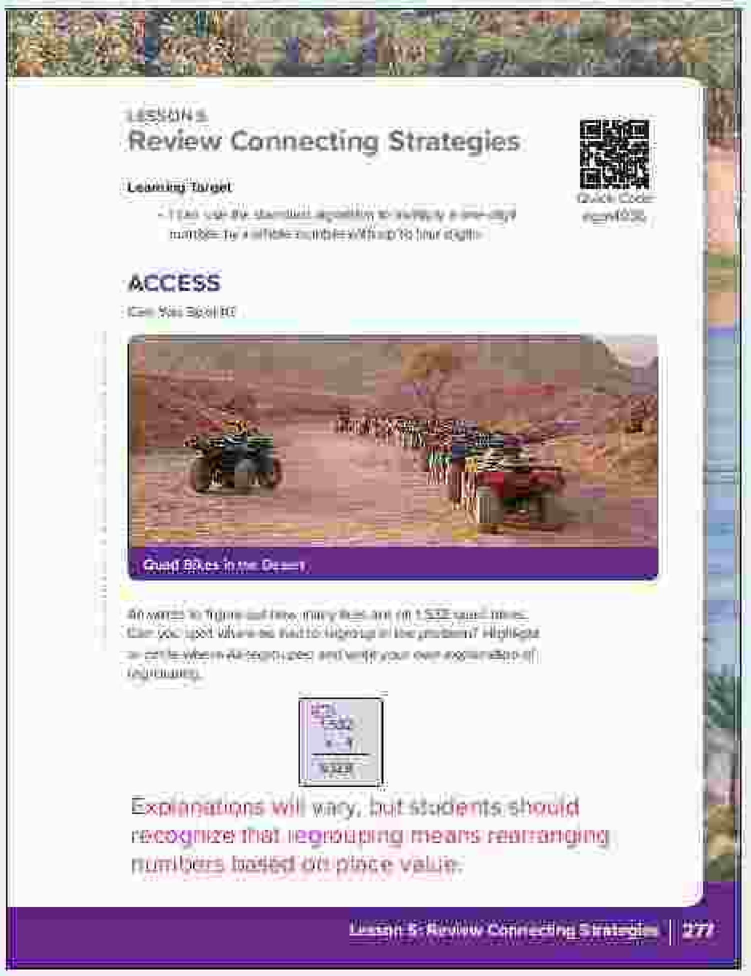
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LESSON 5

Review Connecting Strategies

Learning Target

- I can use the standard algorithm to multiply a one-digit number by a whole number with up to four digits.

ACCESS

Can You Spot It?

Quad Bikes in the Desert

Ali wants to figure out how many tires are on 1,532 quad bikes. Can you spot where he had to regroup in the problem? Highlight or circle where Ali regrouped and write your own explanation of regrouping.

Explanations will vary, but students should recognize that regrouping means rearranging numbers based on place value.

Lesson 5: Review Connecting Strategies | 277

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may forget to record their regrouped digit or attempt to place two digits in the product at once.

Can You Spot It?

1. Direct students to Lesson 5 ACCESS Can You Spot It? and ask students to read the problem, answer the question, and write their own explanation for regrouping.

$$\begin{array}{r} {}^{2\,1} \\ 1{,}532 \\ \times \quad 4 \\ \hline 6{,}128 \end{array}$$

2. Ask volunteers to share their explanations with the whole group. Clear up any misconceptions.

Answer Key for Can You Spot It?

Ali had to regroup in the Hundreds and Thousands places. Explanations will vary, but students should recognize that regrouping means rearranging numbers based on place value.

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BUILD (40 min)

Matching the Models (30 min)

1. Assign students into groups of 3.
2. Distribute sets of cards to each group. One student should receive Set A, one should receive Set B, and one should receive Set C. Have students cut out their cards and keep them separate from the other students' cards in their group.
3. To play the game, one student plays a card and the other students find the matching cards in their set.
4. Once students have a match, they should review the steps for solving the problem using the standard algorithm and discuss where they see regrouping in the problem.
5. Students continue to play until no cards remain.

   TEACHER NOTE: This game can also be played as a matching game with groups of 2–4 students. For the matching game, students only play with two sets of cards at a time. They lay the cards face down and turn over two cards. If the cards match, they keep the cards. If the cards do not match, they should turn them over and the next player gets a turn. Students should try to remember where the cards were placed to make a match when it is their turn.

6. If time remains, students can create their own matching cards to display in the classroom.

Fix the Error (10 min)

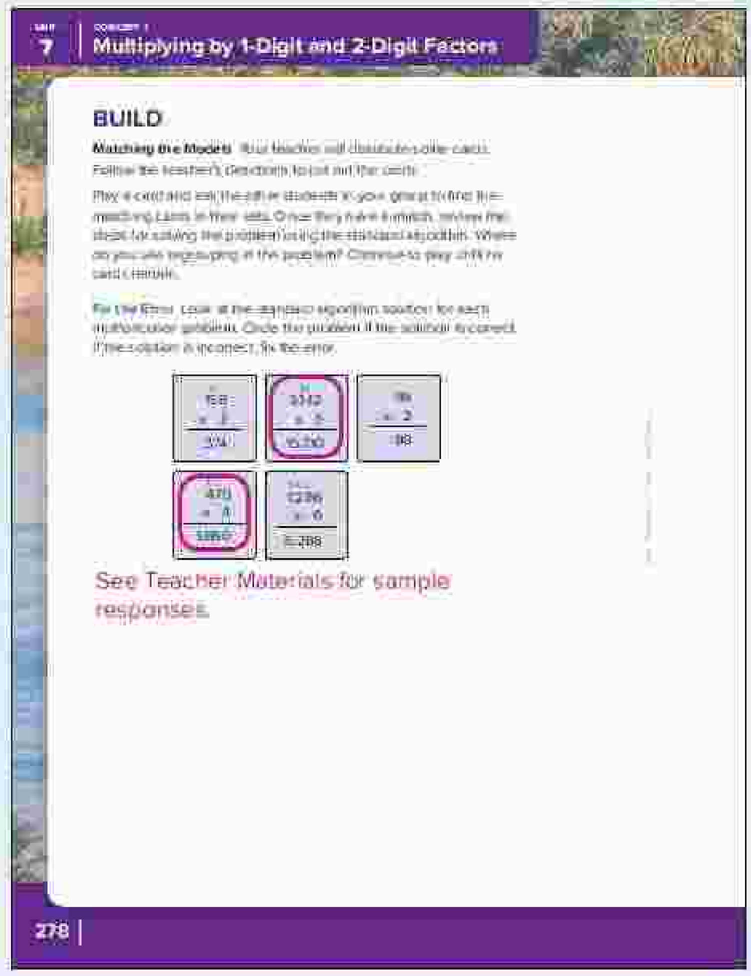
1. Direct students to Lesson 5 BUILD Fix the Error. Ask students to look for errors in using the standard algorithm. If the problem is solved incorrectly, students must fix the error.

Answer Key for Fix the Error:

1. 158 × 3 = 374 is incorrect. The student did not regroup when multiplying the Tens place.
2. 3,142 × 5 = 15,710 is correct.
3. 98 × 2 = 86 is incorrect. The student did not regroup at all.
4. 470 × 4 = 1,880 is correct.
5. 1,286 × 6 = 6,286 is incorrect. The student regrouped, but did not add in the value on top after multiplying.

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UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors

BUILD

Matching the Models

See Teacher Materials for sample responses.

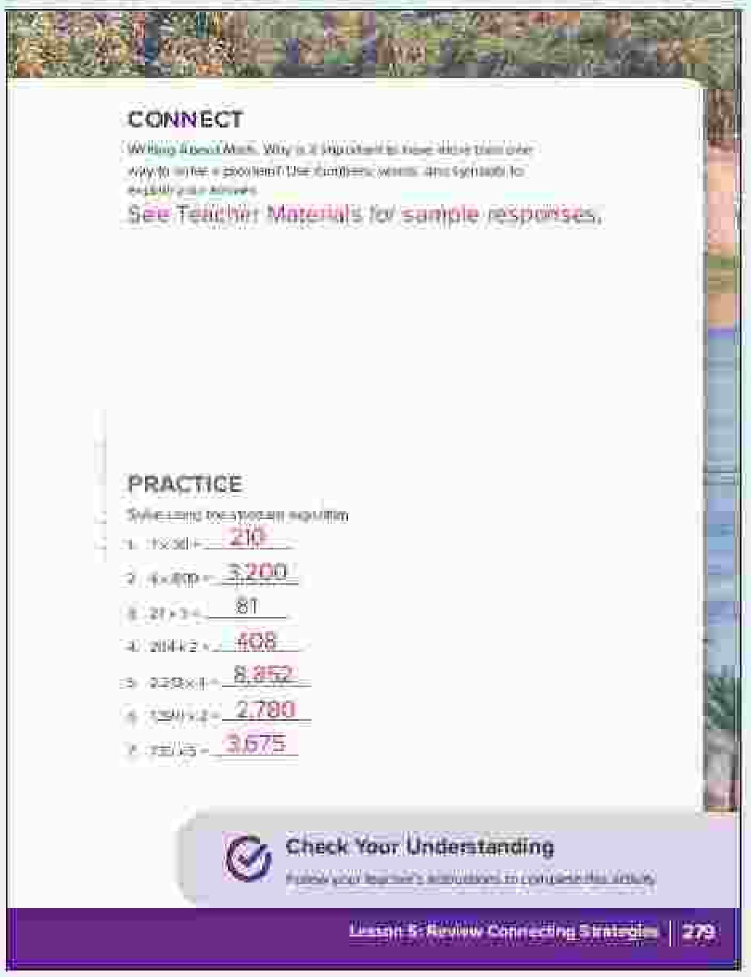
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CONNECT

See Teacher Materials for sample responses.

PRACTICE

1. 210
2. 3,200
3. 81
4. 408
5. 8,852
6. 2,780
7. 3,675

Check Your Understanding

Lesson 5: Review Connecting Strategies | 279

CONNECT (7 min)

Writing About Math

Ask students to turn to Lesson 5 CONNECT Writing About Math and respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask volunteers to share their responses with the class. Possible responses to highlight during the discussion include: some strategies are more efficient than others, they can try a different strategy if they get stuck, they can use a different strategy to check their answer, they can use a strategy they are comfortable with while they are practicing a new strategy.

PRACTICE

Direct students to Lesson 5 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve the problems using the standard algorithm.

1. 74 × 2 = 148
2. 122 × 4 = 488
3. 472 × 5 = 2,360
4. 383 × 2 = 766
5. 1,074 × 3 = 3,222

TEACHER NOTE: It is recommended that students complete this Check Your Understanding prior to continuing with this unit. It will provide valuable information on how students are progressing before moving on to multiplying by two digits.

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LESSON 6
Two-Digit Multiplication

Lesson Overview

In this lesson, students use the Distributive Property to multiply a two-digit number by a multiple of 10.

Lesson Essential Question

- How can we use our knowledge of place value to multiply and divide more efficiently?

Learning Objectives

In this lesson

- Students will identify patterns when multiplying two multiples of 10.
- Students will multiply a two-digit number by a multiple of 10.
- Students will assess the reasonableness of an answer using estimation and mental math.

Grade-Level Standards

4.A.2.c Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

Distributive Property of Multiplication

Materials List

No additional materials needed

Preparation

No additional preparation needed

DIGITAL



Lesson 6
Two-Digit Multiplication

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UNIT 7 | Multiplying by 1-Digit and 2-Digit Factors

LESSON 6

Two-Digit Multiplication

Learning Targets

ACCESS

1. 200 2,000
2. 500 5,000

BUILD

30 × 50 = 1,500

20 × 80 = 1600

280

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have difficulty determining the number of zeros in a product when multiplying by multiples of 10, especially when the product of the basic fact ends in zero. For example, students may think that 80 × 50 = 400 rather than 4,000.

Mental Math

1. Ask students to turn to Lesson 6 ACCESS Mental Math and follow along as you read the problems aloud. For each problem, ask students to identify which answer is reasonable and to explain how they know.
   - Is 56 × 4 closer to 200 or closer to 2,000? 200
   - Is 156 × 4 closer to 500 or closer to 5,000? 500
2. Write each of the following problems on the board one at a time. Ask students to try to solve them mentally without pencil and paper. Students may raise their hands or give another signal when they have an answer.
   - 32 × 3 = 96
   - 232 × 3 = 696
   - 71 × 5 = 355
   - 371 × 5 = 1,855

   TEACHER NOTE If necessary, support students with solving the problems by decomposing and distributing for them. For example, 232 × 3 is the same as 200 × 3 plus 30 × 3 plus 2 × 3.

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BUILD (40 min)

Ten Times (10 min)

1. Ask students to share with their Shoulder Partner what a multiple of 10 is.
2. Direct students to Lesson 6 BUILD Ten Times.
3. Ask students to make a prediction about what will happen when two multiples of 10 are multiplied together.
4. Ask students to share their predictions. Make sure the students see that each product will have at least two zeros.
5. Complete the rest of the problems together. Help students identify the basic fact and place two zeros at the end of the product.

Answer Key for Ten Times:

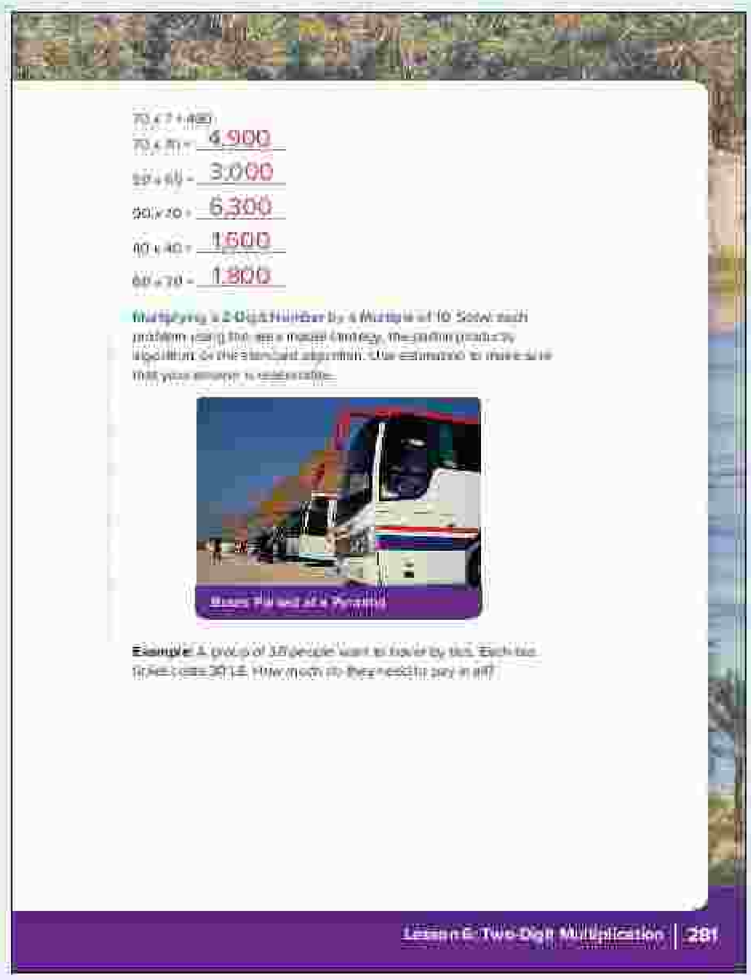
1. 30 × 50 = 1,500
2. 20 × 80 = 1,600
3. 70 × 70 = 4,900
4. 50 × 60 = 3,000
5. 90 × 70 = 6,300
6. 40 × 40 = 1,600

Multiplying a 2-Digit Number by a Multiple of 10 (30 min)

1. Ask students to recall the different strategies that they have learned for multiplying numbers so far—the area model, the partial products algorithm, and the standard algorithm. Remind students that numbers can be decomposed when multiplying because of the Distributive Property of Multiplication. Share with students that they will use all of these strategies again as they learn to multiply two 2-digit numbers.
2. Ask students to turn to Lesson 6 Multiplying a Two-Digit Number by a Multiple of 10. Ask a volunteer to read the problem aloud. Model solving 38 × 30 using an area model. First, ask students to help you decompose 38 according to the value of each of its digits (30 + 8). Explain that since 30 is a multiple

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4,900
3,000
6,300
1,600
1,800

Lesson 6: Two-Digit Multiplication | 281

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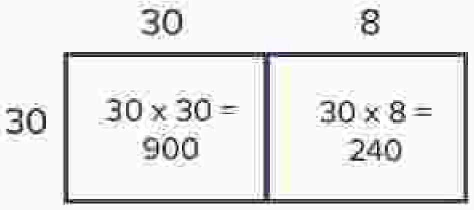
UNIT 7 | CONCEPT 1

Multiplying by 1-Digit and 2-Digit Factors

	Problem	Area Model	Numbers and Symbols
1.	[illegible]		2,480
2.	[illegible]		3,850
3.	[illegible]		1,620
4.	[illegible]		3,120
5.	[illegible]		880
6.	[illegible]		450
7.	[illegible]		400
8.	[illegible]		2,880

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of 10, that it does not need to be decomposed because they just identified some patterns for working with multiples of 10.



3. Model recording the calculations used in the area model with numbers and symbols. Ask students to record your work in their Student Edition.

   $38 \times 30 =$ ______

   $(30 + 8) \times 30$

   $(30 \times 30) + (8 \times 30)$

   $900 + 240 = 1{,}140$

   $38 \times 30 = 1{,}140$

4. Ask students if they have any questions. Clear up misconceptions before moving on.

5. Direct students to Lesson 6 BUILD Multiplying a Two-Digit Number by a Multple of 10 and ask them to complete the additional problems with a partner.

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CONNECT (7 min)

Error Analysis

Direct students to Lesson 6 CONNECT Error Analysis and ask to read the directions. Give students time to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss how they used patterns when multiplying by 10s to solve the multiplication problems more efficiently.

PRACTICE

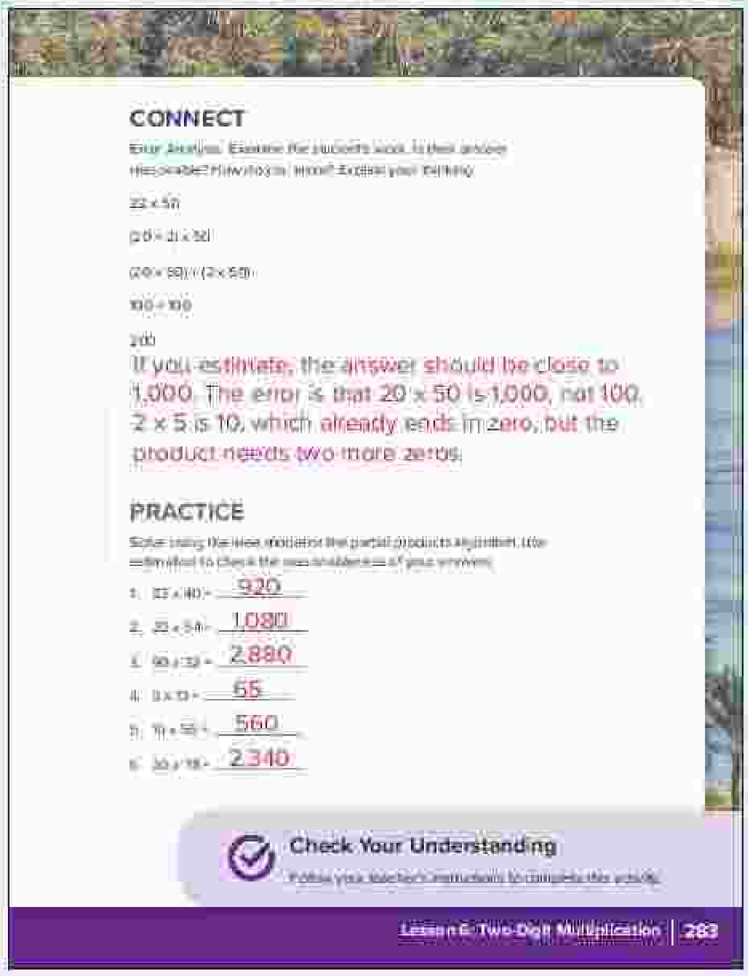
Direct students to Lesson 6 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the area model or the partial products algorithm. Use estimation to check the reasonableness of your answers.

60 × 73 = 4,380 — Possible estimate: 60 × 70 = 4,200
30 × 70 = 2,100 — Possible estimate: 30 × 70 = 2,100
4 × 532 = 2,128 — Possible estimate: 4 × 500 = 2,000
30 × 54 = 1,620 — Possible estimate: 30 × 50 = 1,500
82 × 40 = 3,280 — Possible estimate: 80 × 40 = 3,200

PRINT
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CONNECT

If you estimate, the answer should be close to 1,000. The error is that 20 × 50 is 1,000, not 100. 2 × 5 is 10, which already ends in zero, but the product needs two more zeros.

PRACTICE

1. 920
2. 1,080
3. 2,880
4. 65
5. 560
6. 2,340

Check Your Understanding

Lesson 6: Two-Digit Multiplication | 283

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Materials List

- Unit 7 Lesson 7 Area Model Cards (one set per student)
- Scissors
- Glue sticks

Preparation

Photocopy the Blackline Master at the end of the volume.

DIGITAL

Lesson 7

Area Models and Two-Digit Multiplication

Quick Code: egmt4038

LESSON 7
Area Models and Two-Digit Multiplication

Lesson Overview

In this lesson, students extend their understanding of the area model of multiplication and create area models to represent two-digit by two-digit multiplication.

Lesson Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will be able to use the area model to solve two-digit by two-digit multiplication problems.

Grade-Level Standards

4.A.2.c Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

Vocabulary Check-In

Review vocabulary as needed.

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ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may incorrectly decompose the factors in the problem, making it difficult for them to use the multiples of 10 to solve the problem.
- Students may not multiply the correct numbers together, giving them an incorrect product.

Be the Teacher

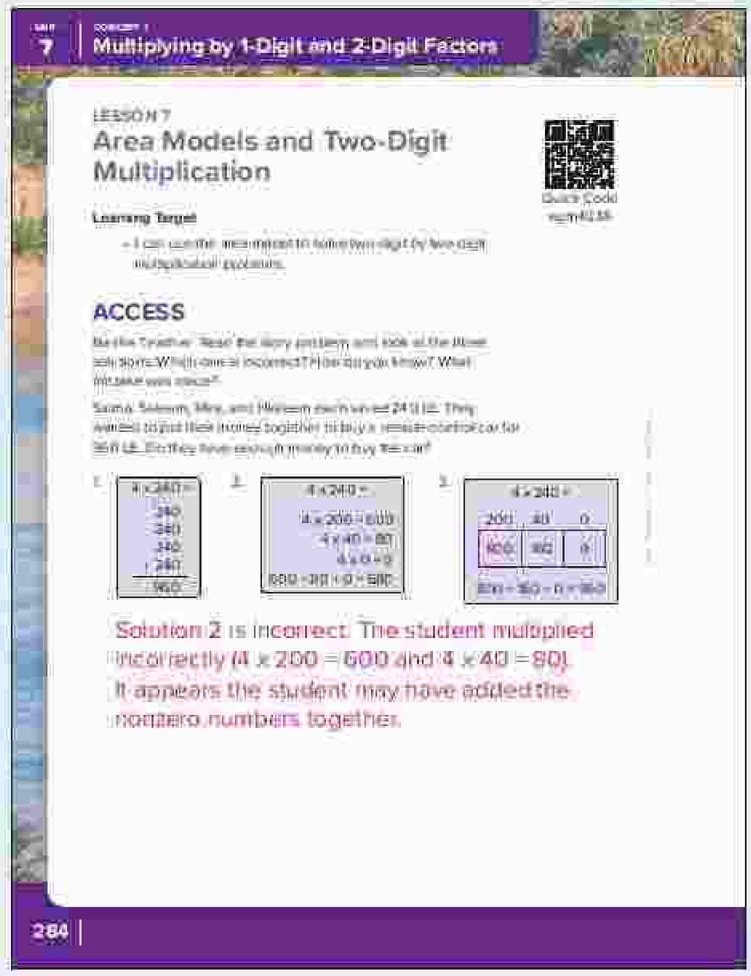
1. Direct students to Lesson 7 ACCESS Be the Teacher. Go over the directions with students and have them work independently to identify which problem does not belong.
2. After two minutes, ask students to share their thinking with a partner. Encourage students to listen to their partner's reasoning, particularly if they selected different solutions.
3. Ask volunteers to share their thinking with the class.

Answer Key for Be the Teacher:

Solution 2 is incorrect. The student multiplied incorrectly ($4 \times 200 = 600$ and $4 \times 40 = 80$). It appears the student may have added the nonzero numbers together.

PRINT

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UNIT 7 | CONCEPT 1 Multiplying by 1-Digit and 2-Digit Factors

LESSON 7

Area Models and Two-Digit Multiplication

Learning Target

- [illegible]

ACCESS

[illegible]

Solution 2 is incorrect. The student multiplied incorrectly ($4 \times 200 = 600$ and $4 \times 40 = 80$). It appears the student may have added the nonzero numbers together.

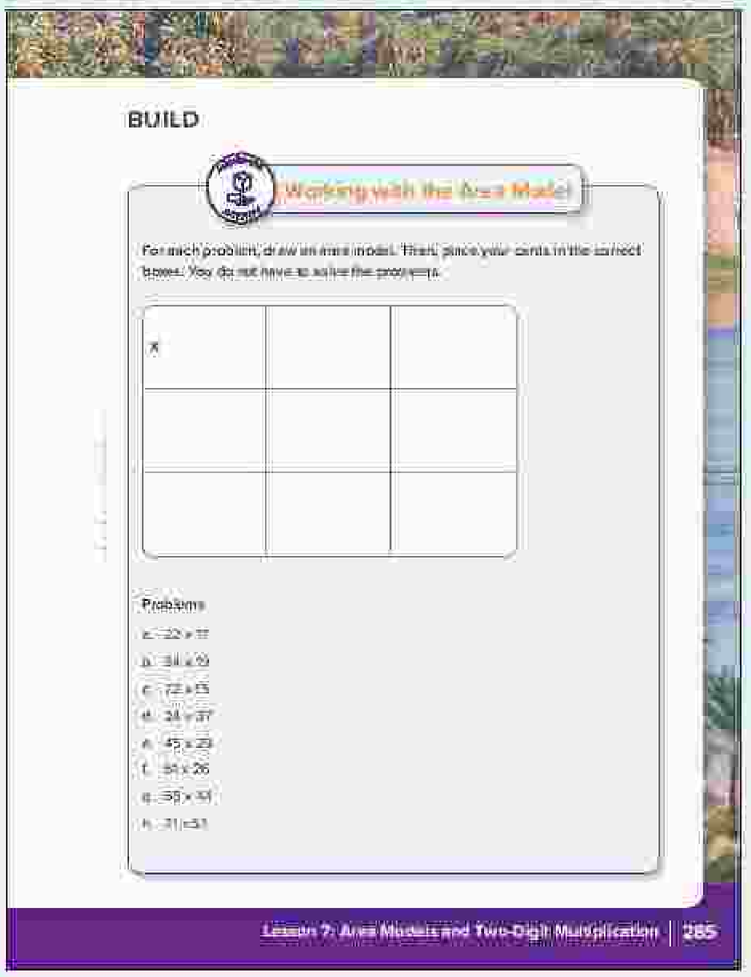
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BUILD

Working with the Area Model

For each problem, draw an area model. Then, place your cards in the correct boxes. You do not have to solve the problems.

x		

Problems

a. 22 × 17
b. 34 × 19
c. 22 × 15
d. 24 × 37
e. 45 × 23
f. 31 × 26
g. 55 × 31
h. 21 × 51

Lesson 7: Area Models and Two-Digit Multiplication | 285

BUILD (45 min)

Working with the Area Model

1. Direct students to Lesson 7 BUILD Working with the Area Model. Ask students to draw an area model for 22 × 17. They do not have to solve the problem.
2. Remind students that they worked on multiplying two-digit numbers during the previous lesson. Ask them to think about how their area model might be different if they were multiplying 22 × 17.
3. Ask a few students to share their ideas.
4. Distribute a set of Area Model Cards to each student. Give them time to cut the cards apart.
5. Tell students they will use the number cards to create an area model for 22 × 17. Ask students to identify the four cards they think they should use to create their area model (20, 2, 10, and 7). Ask students to share their reasoning.
6. Ask students to place the number cards on the mat to create an area model for the multiplication problems.
7. Ask volunteers to share where they put their cards. Confirm that students have placed their cards in one of these formations and have them glue down their cards. Explain that, both arrangements are correct, but the products in the boxes will be in different places, so they have to make sure they are recording and checking their products carefully.

x	20	2
10		
7		

x	10	7
20		
2		

8. Model for students how to use this model to multiply. For the purpose of this example, multiply 20 × 10, 2 × 10, 20 × 7, and 2 × 7 and record each product. However, emphasize to students that the order in which they solve the partial products does not matter. They can begin anywhere.

x	20	2
10	200	20
7	140	14

x	10	7
20	200	140
2	20	14

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9. Ask students how they think they would get the product for the whole problem? They must add all of the partial products together.
10. Give students time to add the partial products (200 + 140 + 20 + 14). Ask volunteers to share their answers for Problem 1.
11. Students should work with a partner to complete Problems 2 and 3.
12. Once students are finished, they should continue to work on the remaining problems. They can choose to continue working with their partner or they can work independently.

Answer Key for Working with the Area Model:

1. 22 × 17 = 374
2. 34 × 19 = 646
3. 72 × 15 = 1,080
4. 24 × 37 = 888
5. 45 × 29 = 1,305
6. 61 × 26 = 1,586
7. 58 × 44 = 2,552
8. 71 × 51 = 3,621

CONNECT (7 min)

Writing About Math

Direct students to Lesson 7 CONNECT Writing About Math and ask them to answer the question.

Answer Key for Writing About Math:

Students should note that both factors are decomposed. Students may notice that numbers are multiplied twice. For example, in 22 × 17, 20 is multiplied by 10 and then again by 7.

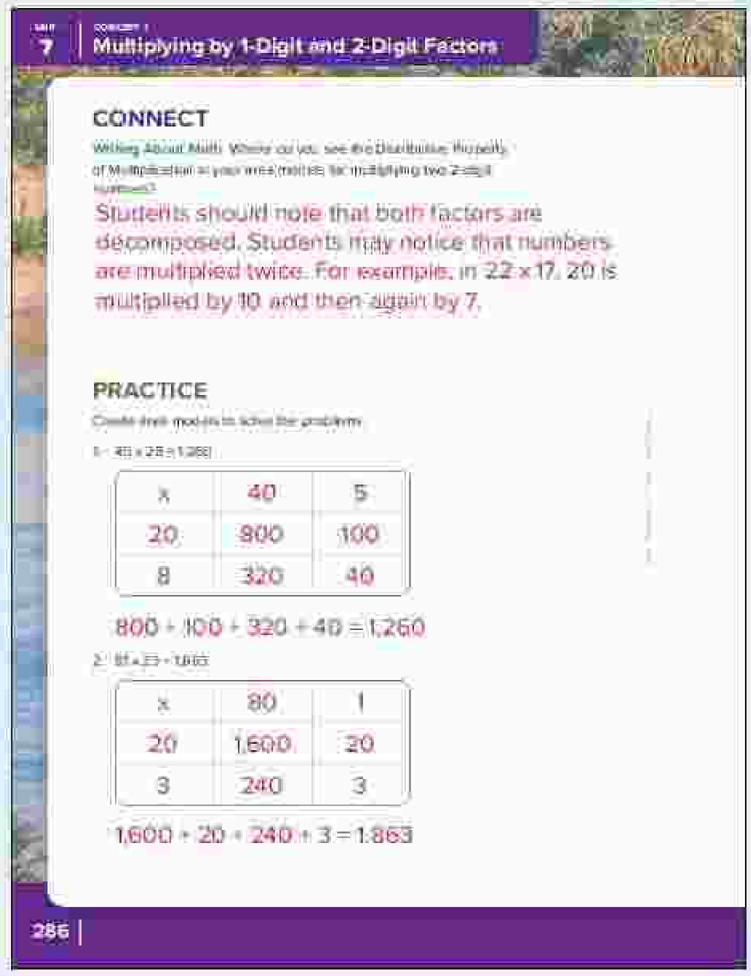
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their thinking with a partner. After students have had time to talk, ask volunteers to share their ideas with the class.

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UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors

CONNECT

Writing About Math: Where do you see the Distributive Property of Multiplication in your area models for multiplying two 2-digit numbers?

Students should note that both factors are decomposed. Students may notice that numbers are multiplied twice. For example, in 22 × 17, 20 is multiplied by 10 and then again by 7.

PRACTICE

Create area models to solve the problems.

1. 45 × 28 = 1,260

x	40	5
20	800	100
8	320	40

800 + 100 + 320 + 40 = 1,260

2. 81 × 23 = 1,863

x	80	1
20	1,600	20
3	240	3

1,600 + 20 + 240 + 3 = 1,863

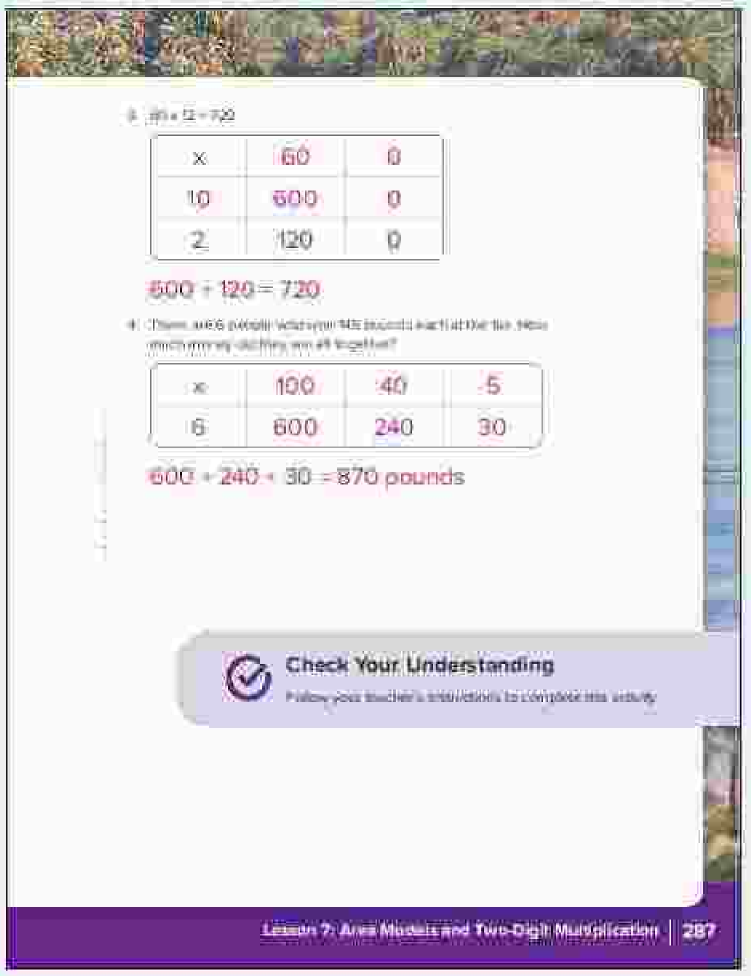
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x	60	0
10	600	0
2	120	0

600 + 120 = 720

x	100	40	5
6	600	240	30

600 + 240 + 30 = 870 pounds

Check Your Understanding

Lesson 7: Area Models and Two-Digit Multiplication | 287

PRACTICE

Direct students to Lesson 7 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve each problem.

1. 17 × 43 = 731

x	10	4
40	400	280
3	30	21

400 + 280 + 30 + 21 = 731

2. 39 × 31 = 1,209

x	30	9
30	900	270
1	30	9

900 + 270 + 30 + 9 = 1,209

3. 50 × 42 = 2,100

x	50	0
40	2,000	0
2	100	0

2,000 + 100 = 2,100

4. The bookstore ordered 34 boxes of a new book. There were 24 books in each box. How many copies of the book did they receive?

x	30	4
20	600	80
4	120	16

600 + 80 + 120 + 16 = 816 copies of the book

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LESSON 8
Algorithms and Two-Digit Multiplication

Lesson Overview

In this lesson, students make connections between area models, the partial products algorithm, and the standard algorithm for two-digit multiplication. Making these connections helps students build deep understanding of multiplication processes. Students use three strategies to solve two-digit by two-digit multiplication problems.

Lesson Essential Questions

- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will apply a variety of strategies to solve two-digit by two-digit multiplication problems.

Grade-Level Standards

4.A.2.c Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

No additional materials needed

Preparation

No additional preparation needed

DIGITAL



Lesson 8

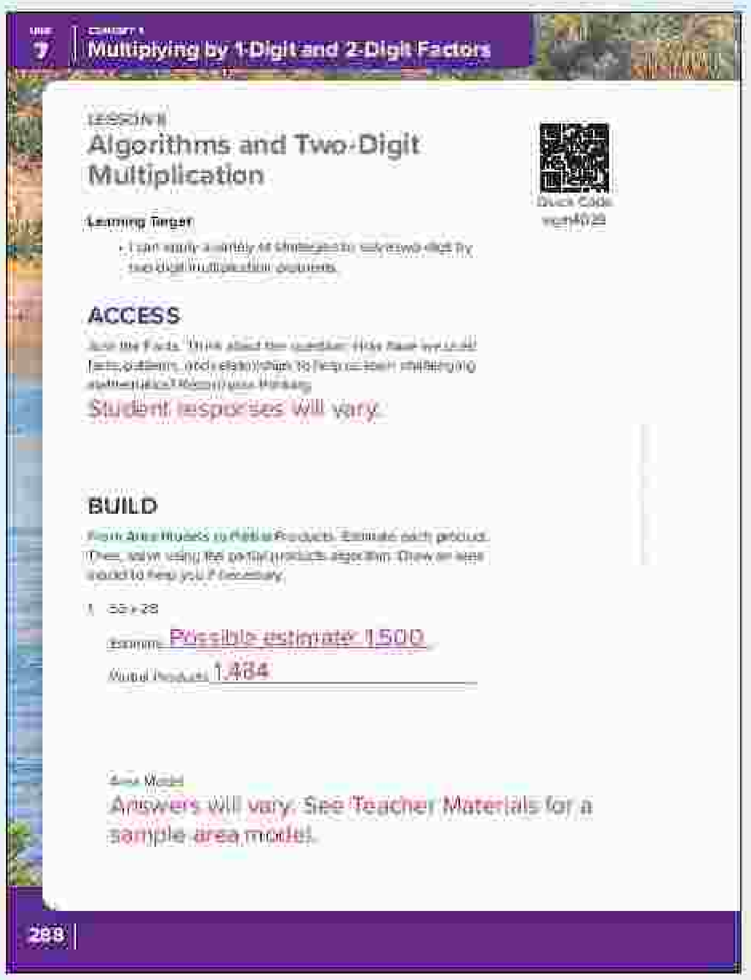
Algorithms and Two-Digit Multiplication

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Unit 7 | Multiplying by 1-Digit and 2-Digit Factors

LESSON 8

Algorithms and Two-Digit Multiplication

Learning Target

ACCESS

Student responses will vary.

BUILD

1. 53 × 28

Estimate: Possible estimate: 1,500

Partial Products: 1,484

Area Model

Answers will vary. See Teacher Materials for a sample area model.

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ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have difficulty decomposing numbers when a problem is written vertically.
- Students may have a hard time keeping track of the partial products and how to distribute the numbers properly.

Just the Facts

1. Ask students the following question:
   - How have we used patterns and relationships to help us learn challenging mathematics?
2. Have students think quietly about the question and quickly record their thinking. Then, ask them to share their thinking with their Shoulder Partner. Finally, ask volunteers to share their thinking with the class.

BUILD (45 min)

From Area Model to Partial Products (20 min)

1. Direct students to Lesson 8 BUILD From Area Models to Partial Products and ask students to estimate the product of 53 × 28. Remind students that rounding is a common way to estimate. If students round the factors to 50 and 30, their estimate is 1,500.
2. Ask students to solve the problem using an area model. Encourage students to compare their answer with their estimate. If their answer is not close to their estimate, then they might have made a mistake multiplying.

×	50	3
20	1,000	60
8	400	24

1,000 + 60 + 400 + 24 = 1,484

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3. Share with students that today they will solve two-digit by two-digit multiplication problems using the partial products algorithm.
4. Ask students to predict how many partial products will result from a two-digit by two-digit multiplication problem.
   Four, because there were four sections in the area model.
5. Model for students how to set up the partial products algorithm. Encourage them to refer to the area model for help with the answers. Remind students that these calculations can be done in any order.

$$\begin{array}{rl} & 53 \\ \times & 28 \\ \hline & (3 \times 8) \\ & (50 \times 8) \\ & (3 \times 20) \\ + & (50 \times 20) \\ \hline \end{array}$$

6. Ask students to complete the partial products and solve the problem.

$$\begin{array}{rl} 53 & \\ \times \quad 28 & \\ \hline 24 & (3 \times 8) \\ 400 & (50 \times 8) \\ 60 & (3 \times 20) \\ + \ 1{,}000 & (50 \times 20) \\ \hline 1{,}484 & \end{array}$$

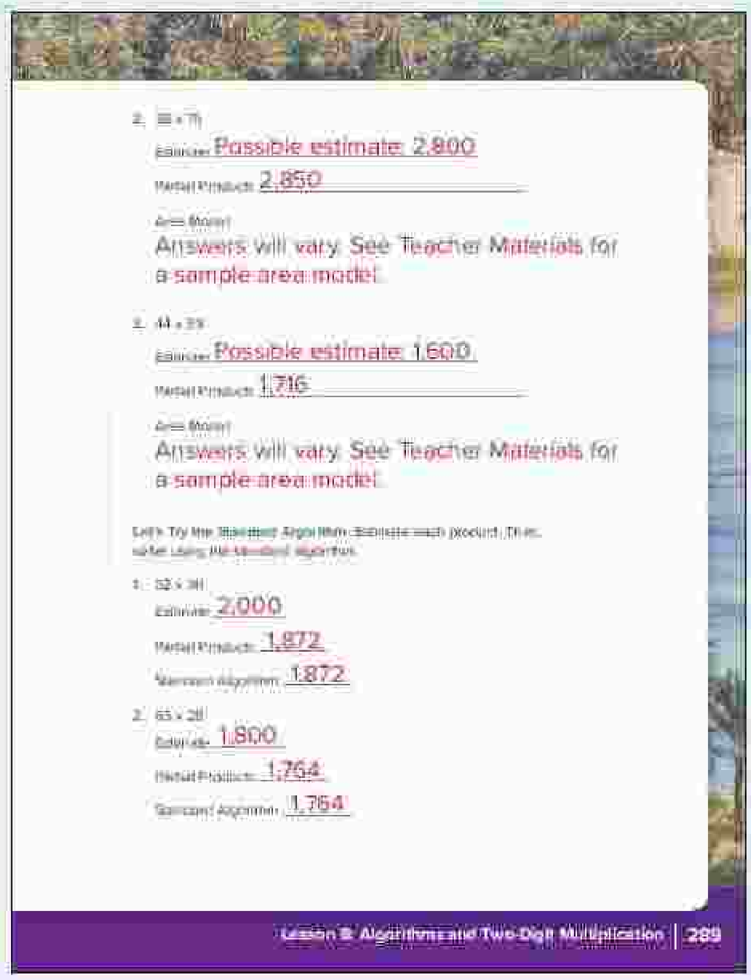
7. Ask students to help you solve Problems 2 and 3, first estimating and then solving using the partial products algorithm.

Answer Key for From Area Model to Partial Products:

1. 53 × 28 = 1,484
2. 38 × 75 = 2,850
3. 44 × 39 = 1,716

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2. 38 × 75
Estimate: Possible estimate: 2,800
Partial Products: 2,850
Area Model
Answers will vary. See Teacher Materials for a sample area model.

3. 44 × 39
Estimate: Possible estimate: 1,600
Partial Products: 1,716
Area Model
Answers will vary. See Teacher Materials for a sample area model.

1. 52 × 36
Estimate: 2,000
Partial Products: 1,872
Standard Algorithm: 1,872

2. 63 × 28
Estimate: 1,800
Partial Products: 1,764
Standard Algorithm: 1,764

Lesson 8: Algorithms and Two-Digit Multiplication | 289

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UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors

3. 46 × 25
Estimate 1,500
Partial Products 1,150
Standard Algorithm 1,150

4. 39 × 18
Estimate 800
Partial Products 702
Standard Algorithm 702

290

Let's Try the Standard Algorithm (25 min)

1. Remind students that although they have been learning different strategies for multiplication, mathematicians work towards being efficient in their calculations. It might take a long time to draw an area model to solve a problem, so they may choose to use an algorithm like partial products or the standard algorithm.
2. Direct students to Lesson 8 Let's Try the Standard Algorithm. Ask students to first estimate the product of 52 × 36, and then solve the problem using partial products. Estimate: 50 × 40 = 2,000

$$\begin{array}{rl} & 52 \\ \times & 36 \\ \hline & 12\ (2 \times 6) \\ & 300\ (50 \times 6) \\ & 60\ (2 \times 30) \\ + & 1{,}500\ (50 \times 30) \\ \hline & 1{,}872 \end{array}$$

3. Model solving the problem using the standard algorithm. Allow students to copy the steps after you have finished.

$$\begin{array}{rr} & {}^{1} \\ & 52 \\ \times & 36 \\ \hline & 312 \\ + & 1{,}560 \\ \hline & 1{,}872 \end{array}$$

4. Ask students to discuss how the partial product problem and the standard algorithm problem connect to each other.
   - The first line is a combination of two of the partial products. It is the same as 6 × 52 or (6 × 2) + (6 × 50).
   - The second line is also a combination of two of the partial products. It is the same as 30 × 52 or (30 × 2) + (30 × 50).
5. Guide students through the rest of the problems. Remind students to compare their answers to their estimates. Encourage students to draw area models or use the partial products algorithm to help them if necessary.

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Answer Key for Let's Try the Standard Algorithm:

1. 52 × 36 = 1,872
2. 63 × 28 = 1,764; Estimate: 1,800
3. 46 × 25 = 1,150; Estimate: 1,500
4. 31 × 94 = 2,914; Estimate: 2,700
5. 24 × 57 = 1,368; Estimate: 1,200
6. 39 × 18 = 702; Estimate: 800

CONNECT (7 min)

Writing About Math

Direct students to Lesson 8 CONNECT Writing About Math and ask them to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their thinking and their reasoning. Encourage students to ask each other questions and to offer each other help.

PRACTICE

Direct students to Lesson 8 PRACTICE and have them complete the problems. Address student errors and misconceptions.

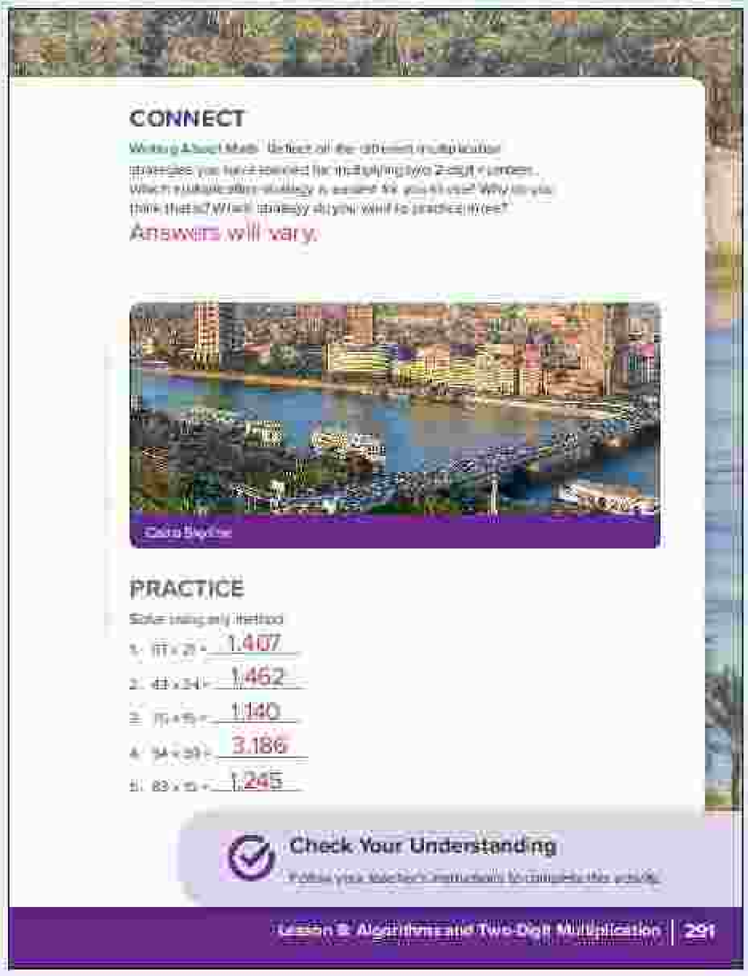
Check Your Understanding

Solve using any method.

1. 46 × 29 = 1,334
2. 52 × 76 = 3,952
3. 64 × 23 = 1,472
4. 83 × 18 = 1,494
5. 94 × 33 = 3,102

PRINT

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CONNECT

Answers will vary.

Cairo Skyline

PRACTICE

1. 1,407
2. 1,462
3. 1,140
4. 3,186
5. 1,245

Check Your Understanding

Lesson 8: Algorithms and Two-Digit Multiplication | 291

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LESSON 9
Putting It All Together

Lesson Overview

In this lesson, students use addition, subtraction, multiplication, or a combination of operations to solve story problems.

Lesson Essential Question

- How do we use math to help us understand and solve real-world problems?

Learning Objectives

In this lesson

- Students will apply the Three Reads strategy to analyze and solve story problems.
- Students will add, subtract, or multiply to solve story problems.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

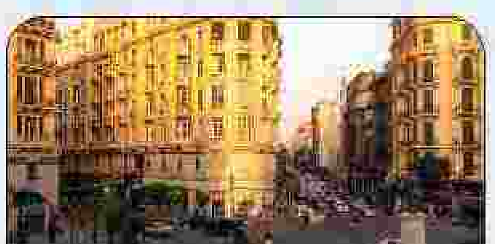
- Unit 7 Lesson 9 Story Problem Cards (1 card per student)

Preparation

Photocopy the Blackline Master at the end of the volume.

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Lesson 9

Putting It All Together

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ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may solve part of a problem and think they are finished. Using strategies to thoroughly understand what is happening in a problem before solving is an important step in the problem-solving process.
- Students who rely on key words may misinterpret what is happening in the problem. Using keywords in context is helpful in problem solving, but they are not a foolproof solution strategy.

Number Talk

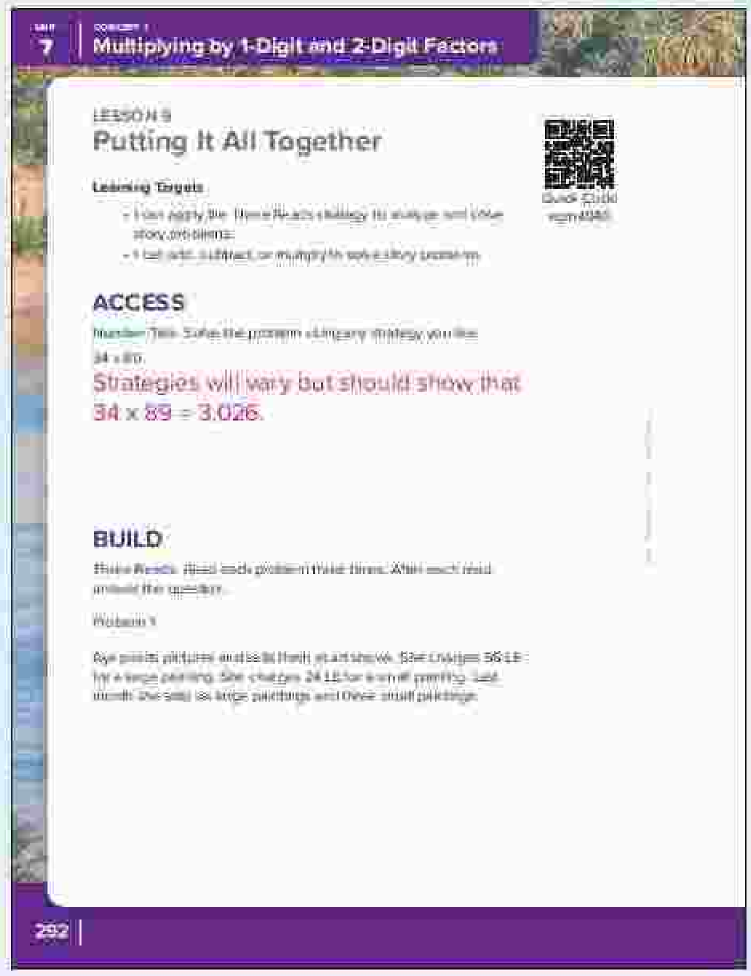
1. Direct students to Lesson 9 ACCESS Number Talk. Ask students to use any strategy to solve the multiplication problem.
2. Ask students to share their answers. Record all answers, including the incorrect ones.
3. Engage students in a conversation about the answers. Use them as an opportunity to promote discussion about misconceptions and errors. Remind students that they are still learning and analyzing errors is a very effective way to learn.

Answer Key for Number Talk:

1. $34 \times 89 = 3{,}026$

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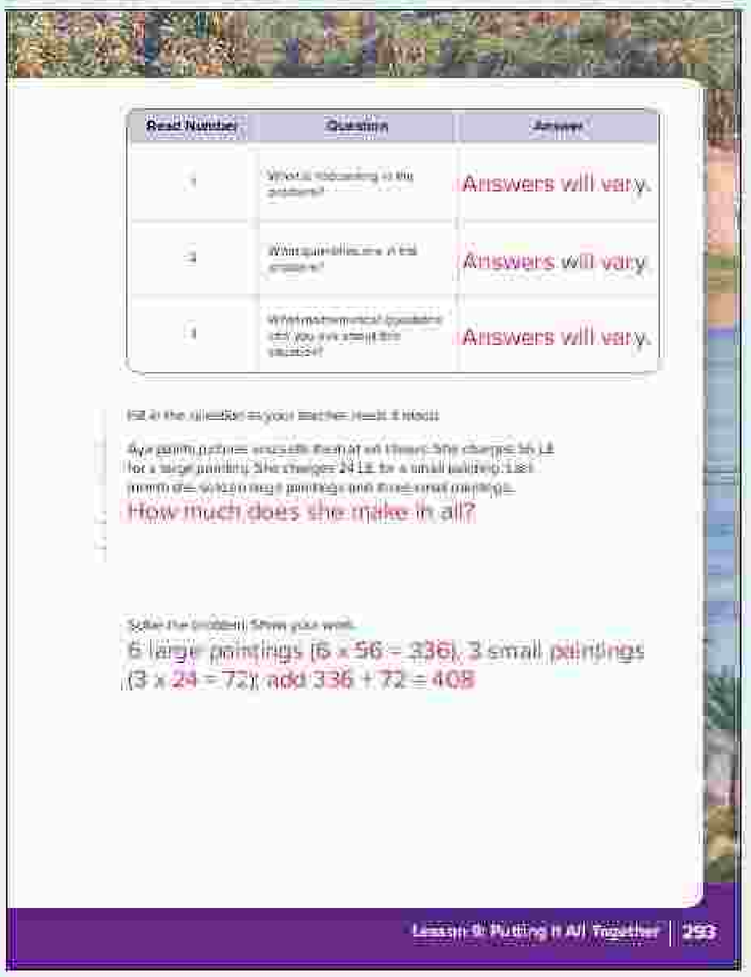


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Read Number	Question	Answer
1	What is happening in the problem?	Answers will vary.
2	What quantities are in the problem?	Answers will vary.
3	What mathematical questions can you ask about this situation?	Answers will vary.

[illegible]

[illegible]

How much does she make in all?

[illegible]

6 large paintings (6 × 56 = 336), 3 small paintings (3 × 24 = 72); add 336 + 72 = 408

Lesson 9: Putting It All Together | 293

BUILD (45 min)

Three Reads (15 min)

1. Direct students to the first story problem in Lesson 9 BUILD Three Reads. Ask students to follow along while you read the problem aloud.
2. Ask students what is happening in the problem. Students should record their thinking.
3. For the second read, choral read the problem with the entire class. Ask the students what quantities they observe in the problem. Students should record their thinking.
4. For the third read, ask students to read the problem with a partner.
5. Ask students what mathematical questions they could ask about this situation. Students should record their questions.
6. Reveal to students the actual question for the story problem and ask them to write the question in the blank: How many pounds did Aya make in all?
7. Ask students to work with a partner to show how they would organize the information in the problem and solve. Tell students there are multiple steps to solving this story problem.
8. Call on students to share their answers.

   TEACHER'S NOTE: If needed, use a Think Aloud to show students how to organize the information for the problem.

9. Ask students to work with a partner to solve Problem 2 using the Three Reads strategy. Go over the answer with students.

Answer Key for Three Reads:

1. 6 large paintings (6 × 56 = 336) and 3 small paintings (3 × 24 = 72). 336 + 72 = 408 LE
2. 210 kg Thursday; 210 × 2 = 420 kg Friday; 130 kg Saturday; 420 – 130 = 290 kg

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Story Problem Match (30 min)

1. Distribute the Lesson 9 Story Problem Cards. Give each student (or pair of students) one card.
2. Ask students to read their card, and then try to find the student who has the solution steps or story problem that matches.
3. When all students have found their match, ask them to record their problem number and solve their problem in Lesson 9 BUILD Story Problem Match.
4. If time allows, collect all cards and redistribute them so students can complete the activity again.
5. At the end of BUILD, go over all of the answers with students.

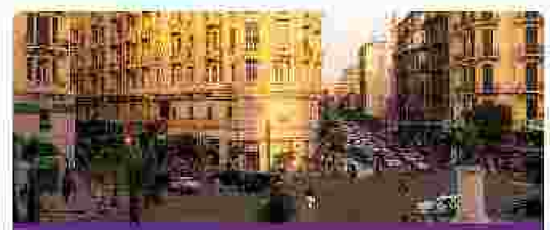
Answer Key for Story Problem Match:

1. 195 kilometers
2. 1,305 kilometers
3. 305 seedlings
4. 11,718 car accidents
5. 623 pages
6. 380 tickets
7. 390 kilometers
8. 852 stickers

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UNIT 7 | CONCEPT 1
Multiplying by 1-Digit and 2-Digit Factors



Talaat Harb Square in Cairo

Problem 2

On Thursday, the Meat King Market sold 210 kilograms of ground beef. On Friday, it sold twice that amount. On Saturday, it sold only 130 kilograms.

Read Number	Question	Answer
1	[illegible]	Answers will vary.
2	[illegible]	Answers will vary.
3	[illegible]	Answers will vary.

Solve the problem. Show your work.

On Thursday, the Meat King Market sold 210 kilograms of ground beef. On Friday, it sold twice that amount. On Saturday, it sold only 130 kilograms. How much more meat did the market sell on Friday than on Saturday? 210 kilograms Thursday; $210 \times 2 =$ 420 kilograms Friday; 130 kilograms Saturday; $420 - 130 = 290$ kilograms

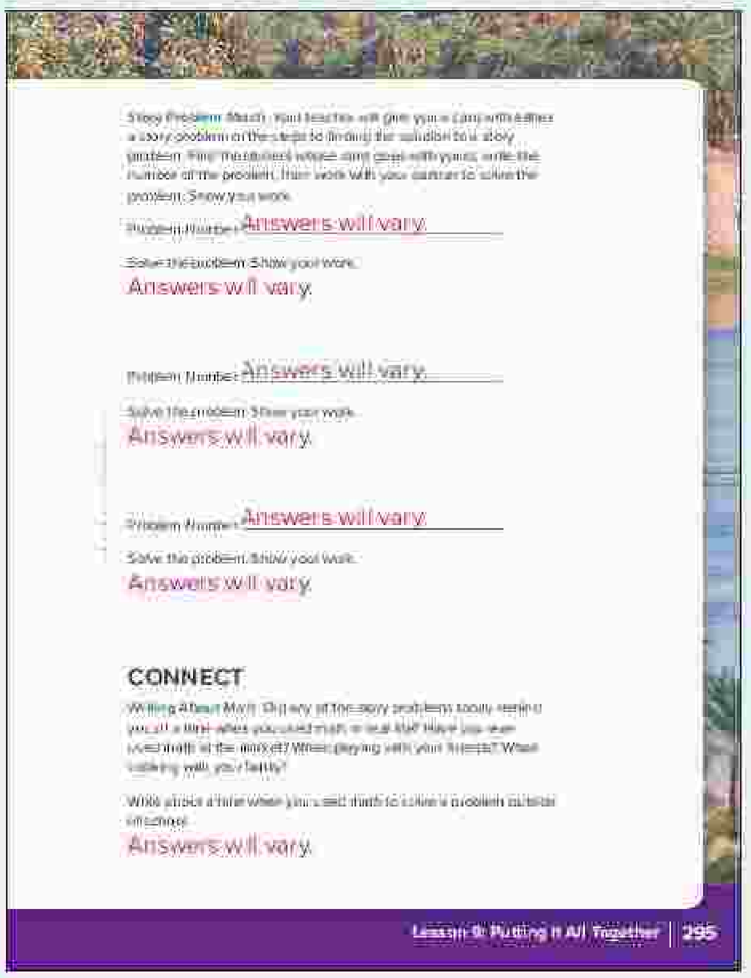
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Story Problem Match: Your teacher will give you a card with either a story problem or the steps to finding the solution to a story problem. Find the student whose card goes with yours, write the number of the problem, then work with your partner to solve the problem. Show your work.

Problem Number: Answers will vary.

Solve the problem. Show your work.

Answers will vary.

Problem Number: Answers will vary.

Solve the problem. Show your work.

Answers will vary.

Problem Number: Answers will vary.

Solve the problem. Show your work.

Answers will vary.

CONNECT

Writing About Math: Did any of the story problems today remind you of a time when you used math in real life? Have you ever used math at the market? When playing with your friends? When cooking with your family?

Write about a time when you used math to solve a problem outside of school.

Answers will vary.

Lesson 9: Putting It All Together | 295

CONNECT (7 min)

Writing About Math

Direct students to Lesson 9 CONNECT Writing About Math and ask them to respond to the prompt.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask volunteers to share their responses to the Writing About Math prompt.

PRACTICE

Direct students to Lesson 9 PRACTICE and have them complete the problems. Address student errors and misconceptions.

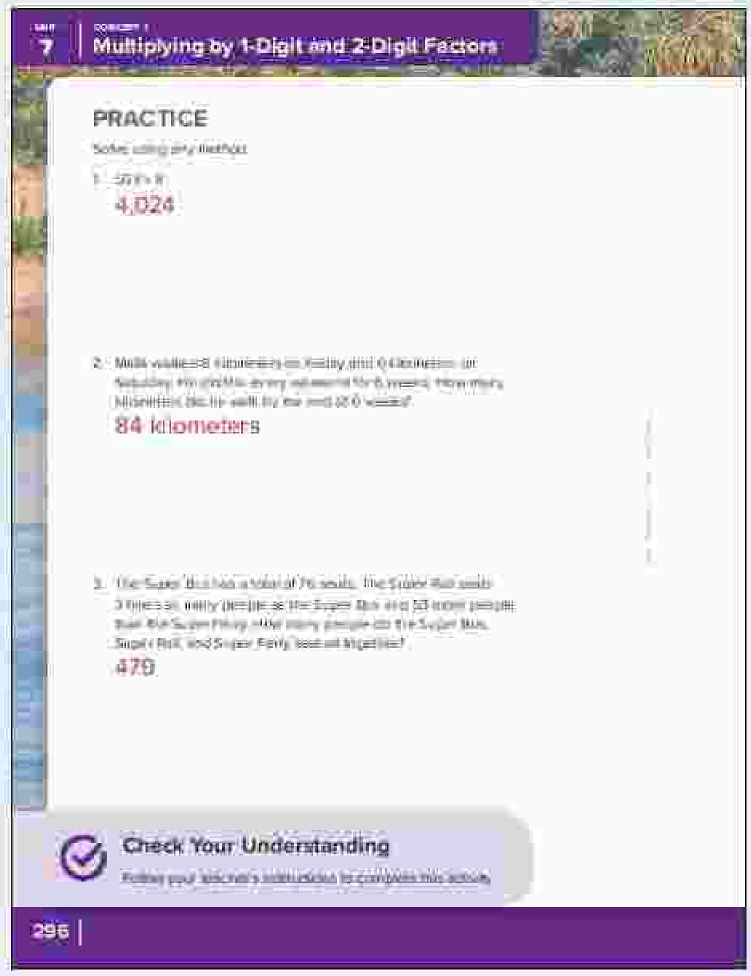
Check Your Understanding

Solve using any method

1. Hamed uses 3 lemons to make 1 pitcher of lemonade. He makes 15 pitchers. How many lemons does he use all together?
   $3 \times 15 = 45$ lemons
2. A teacher bought 7 packs of pencils. Four of the packs had 20 pencils and the other 3 packs had 12 pencils. How many pencils did the teacher have in all?
   $(20 \times 4) + (3 \times 12) = 80 + 36 = 116$
3. $45 \times 12 = 540$

PRINT

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UNIT 7 | CONCEPT 1

Multiplying by 1-Digit and 2-Digit Factors

PRACTICE

1. 4,024

2. 84 kilometers

3. 479

Check Your Understanding

296



Materials List

Materials may vary

Preparation

No additional preparation needed

DIGITAL



Concept Check-In and Remediation

Quick Code: egmt4041

Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Multiplying by One-Digit and Two-Digit Factors. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Concept Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?
- How do we use math to help us understand and solve real-world problems?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to multiplying by one-digit and two-digit factors.

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Multiplying by 1-Digit and 2-Digit Factors

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.A.2.b Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.

4.A.2.c Multiply two two-digit numbers, with and without regrouping, using strategies based on place value and the properties of operations.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

Review concept vocabulary as needed.

COMMON MISCONCEPTIONS AND ERRORS

- While there are multiple ways to decompose a number, numbers should be decomposed using place value when multiplying.
- Students may incorrectly decompose the factors according to their digits rather than according to the value of their digits.
- Students may have difficulty determining the number of zeros in a product when multiplying by multiples of 10, especially when the product of the basic fact ends in zero. Students sometimes have difficulty demonstrating proper regrouping when using the standard algorithm for multiplication. They may forget to record their regrouped digit or attempt to place two digits in the product at once.
- Students may have a hard time keeping track of the partial products and how to distribute the numbers properly.

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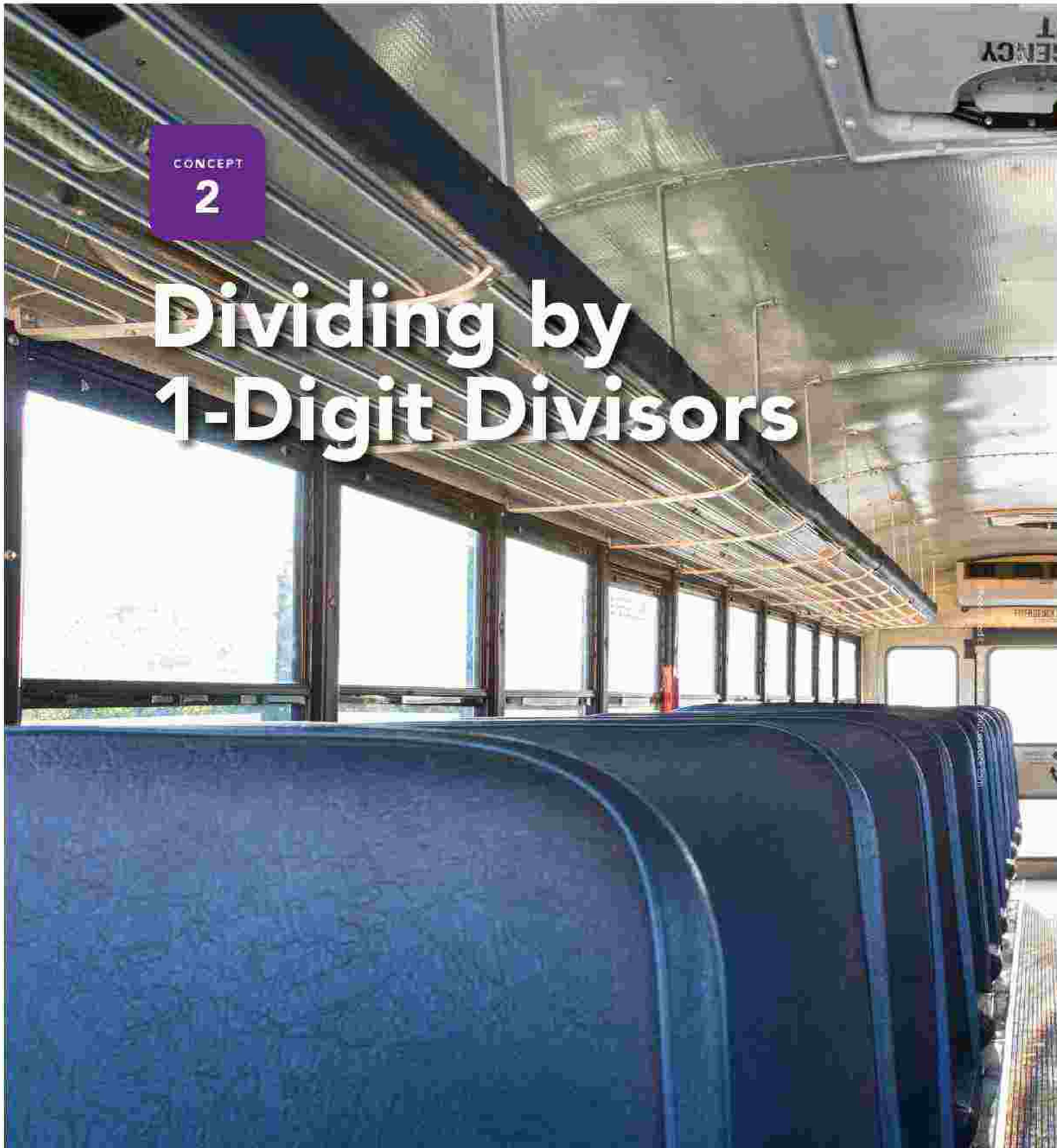
Remediation: Correcting Misconceptions

If...	**Then...**
Students are not able to recognize patterns with zeros when multiplying by a multiple of 10, 100, and 1,000.	Review Unit 5 Lesson 7 and Unit 7 Lesson 6. Consider engaging students in hands-on practice where they highlight the basic fact and place a check mark over each zero in the factors as they write a zero in the product. 3 × 400 = 1,200 60 × 70 = 4,200
If...	**Then...**
Students struggle to multiply after decomposing factors.	Review Lessons 2 and 8. Consider engaging students hands-on practice where they use different colors to represent multiplying different sets of factors. 32 × 84 (30 + 2) × (80 + 4) 2,400 + 120 + 160 + 8
If...	**Then...**
Students get confused about what to multiply when the problem is presented vertically.	Review Lesson 8. Engage students in additional hands-on practice where they circle the numbers they are multiplying using different colors. Also, have students practice solving vertical problems alongside an area model solution to help them see the relationships between the two approaches. 48 × 29 72 360 160 800

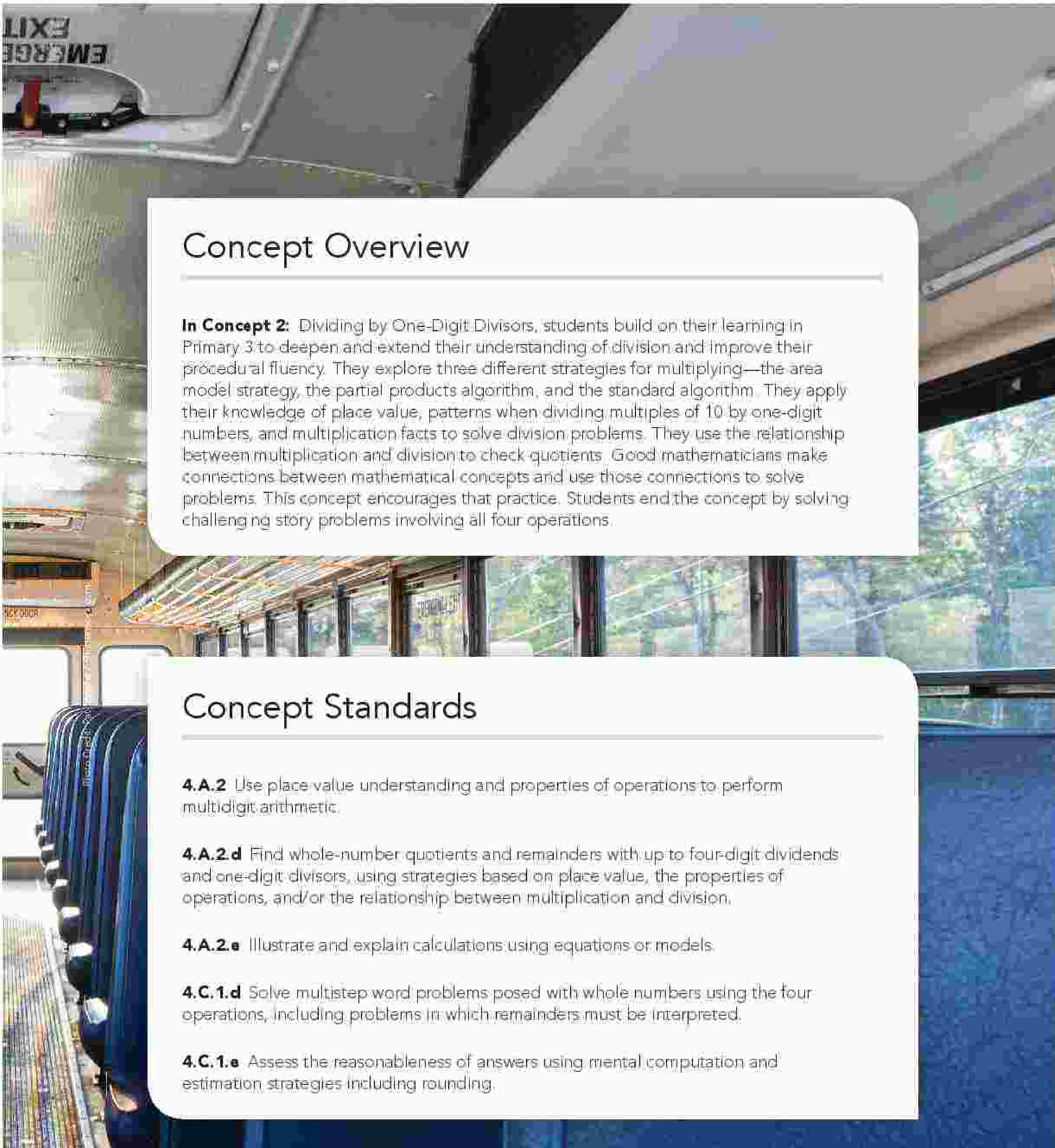
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CONCEPT 2

Dividing by 1-Digit Divisors



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Concept Overview

In Concept 2: Dividing by One-Digit Divisors, students build on their learning in Primary 3 to deepen and extend their understanding of division and improve their procedural fluency. They explore three different strategies for multiplying—the area model strategy, the partial products algorithm, and the standard algorithm. They apply their knowledge of place value, patterns when dividing multiples of 10 by one-digit numbers, and multiplication facts to solve division problems. They use the relationship between multiplication and division to check quotients. Good mathematicians make connections between mathematical concepts and use those connections to solve problems. This concept encourages that practice. Students end the concept by solving challenging story problems involving all four operations.

Concept Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.A.2.e Illustrate and explain calculations using equations or models.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Concept Planner

All lessons are designed to be 60 minutes. The materials listed in this chart are items to gather for each group. Items for the class or for individual students are indicated as needed.

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives
10 Exploring Remainders	No additional materials needed	Dividend Divisor Quotient Remainder	• Students will identify the dividend, divisor, and quotient of a division problem. • Students will solve division problems. • Students will explain what a remainder represents in a division problem.
11 Patterns and Place Value in Division	• Number Cards (6–25) • Six-sided Number Cube • Graph paper (Blackline Master)	Dividend Divisor Quotient Remainder	• Students will use place value, multiplication facts, and patterns with zeros to divide multiples of 10, 100, and 1,000 by one-digit divisors.
12 The Area Model and Division	• Lesson 12 Target Number Cards (Photocopy and cut apart the Blackline Master at the end of the lesson; one set of cards per small group)	Area model Dividend Divisor Quotient Remainder	• Students will use area models to represent and solve division problems.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may be confused by having a reminder in a division problem. They may try to place the remainder into an existing group or into an additional group, both leading to unequal sharing. • Students who are confused with what to do with the reminder may try to add the remainder to the quotient or subtract the remainder from the quotient.	Getting to Zamalek, Going to a Swim Meet, Practice, Check Your Understanding
	• Students may only look at the place with the highest value and try to divide. For example, with 2,400 ÷ 3, they may try to solve 2 ÷ 3 instead of 24 ÷ 3. • Students may be confused by how many zeros to put in a quotient, especially when the related fact includes a zero. For example, the related fact for 2,000 ÷ 4 is 20 ÷ 4 = 5. The quotient is 500 since there are two other zeros in the dividend.	Division Patterns, Riding the Metro, Practice, Check Your Understanding
	• Students may get confused with how many zeros to place at the end of a product. For example, students may write 7 × 3,000 = 2,100 instead of 7 × 3,000 = 21,000. Students may also write 4 × 500 = 200 instead of 4 × 500 = 2,000. • Students may have difficulty determining which multiples to use to start decomposing a dividend when using an area model. It is most effective and efficient to start with multiplying the divisor by 10, 100, or 1,000. For example, for 256 ÷ 8, it is helpful to begin with 8 × 10 = 80 and to work up to 256.	Target Number, Understanding the Area Model, Writing About Math, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
13 The Partial Quotients Algorithm	• No additional materials needed	Partial quotients algorithm	• Students will use the partial quotients algorithm to divide dividends with up to four digits by one-digit divisors.	
14 The Standard Algorithm	• No additional materials needed	Standard algorithm Regroup	• Students will estimate quotients using properties of place value and patterns in multiplication and division. • Students will use the standard algorithm to solve division problems.	
15 Division and Multiplication	• No additional materials needed	Accuracy Reasonable Regroup	• Students will use properties of place value to accurately record quotients. • Students will use the relationship between multiplication and division to check the accuracy of quotients.	



	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may have difficulty determining which multiples to use to start decomposing a dividend when using area models or the partial quotients algorithm. For those students, it may be helpful for them to start by multiplying the divisor by 10, 100, or 1,000. For example, for 7,236 ÷ 6, it is helpful to begin with 6 × 1,000 = 6,000 and then multiply by 10 or 100 until the dividend has been divided evenly.	Model Match, Partial Quotients Algorithm, Writing About Math, Practice, Check Your Understanding
	• Students may attempt to start dividing in the Ones place. However, it is important to start dividing in the place with the highest value when using the standard algorithm for division.	Let's Try It, Writing About Math, Practice, Check Your Understanding
	• Students may attempt to start dividing in the Ones place. However, they must start dividing in the place with the highest value when using the standard algorithm for division. • Students may always put the first digit of the quotient above the first digit in the dividend without considering the place or the value of the digit.	Place Value and the Quotient, Checking Your Answer, From Cairo to Alexandria, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
16 Solving Challenging Story Problems	• Lesson 16 Show and Solve Story Problems (Photocopy and cut apart the story problems in the Blackline Master at the end of the lesson. Place the story problems around the room.)	Review vocabulary as needed.	• Students will organize information in story problems to determine when to add, subtract, multiply, or divide. • Students will solve story problems using addition, subtraction, multiplication, and division.	
Concept Check-In and Remediation	• Materials may vary	Review vocabulary as needed.	• Students will work to correct misconceptions and errors related to dividing by one-digit divisors.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may solve part of a problem and think they are finished. It is important for students to thoroughly understand what is happening in a problem before solving it. This is part of any effective problem-solving process. • Students who rely on key words may misinterpret what is happening in the problem. Using keywords in context is helpful in problem solving.	What is the Problem?, Show and Solve, Writing About Math, Practice, Check Your Understanding

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LESSON 10
Exploring Remainders

Lesson Overview

In this lesson, students apply what they have learned about multiplication, fact families, and place value to build an understanding of division. Students explore what happens when a number cannot be divided evenly into another number. They discuss the meaning and implication of remainders.

Lesson Essential Question

- How can the relationship between multiplication and division be used to solve problems?

Learning Objectives

In this lesson

- Students will identify the dividend, divisor, and quotient of a division problem.
- Students will solve division problems.
- Students will explain what a remainder represents in a division problem.

Grade-Level Standards

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

Vocabulary Check-In

dividend, divisor, quotient, remainder

Materials List

No additional materials needed

Preparation

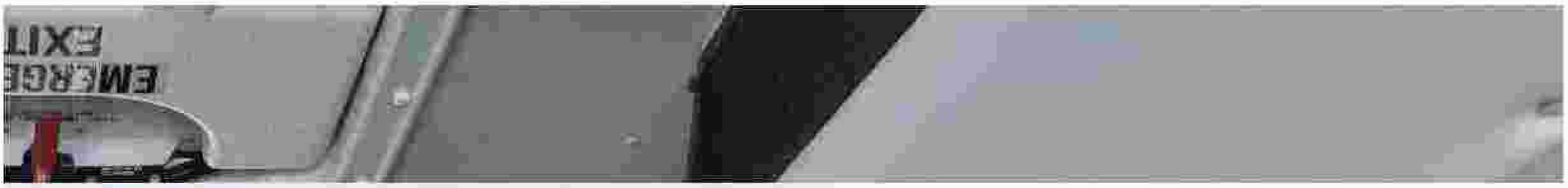
No additional preparation needed

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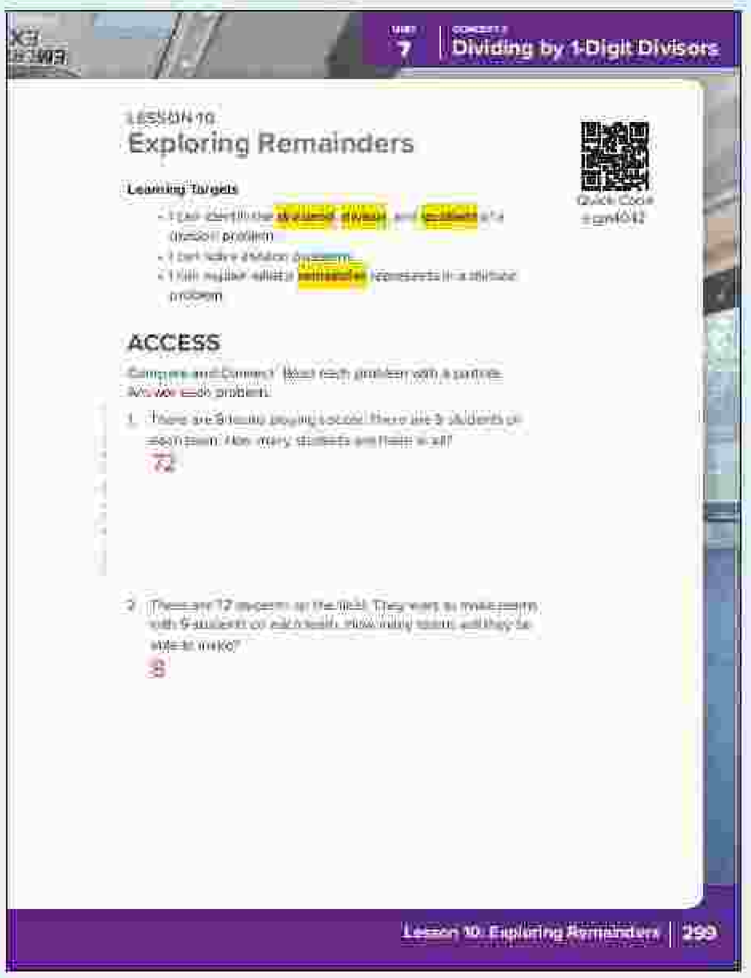
Lesson 10
Exploring Remainders

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7 Dividing by 1-Digit Divisors

LESSON 10
Exploring Remainders

Learning Targets

Quick Code

ACCESS

72

8

Lesson 10: Exploring Remainders | 299

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused by having a reminder in a division problem. They may try to place the remainder into an existing group or into an additional group, both leading to unequal sharing.
- Students who are confused with what to do with the reminder may try to add the remainder to the quotient or subtract the remainder from the quotient.

Compare and Connect

1. Direct students to Lesson 10 ACCESS Compare and Connect. Ask them to read the three problems with a partner.
2. Ask students to discuss how the problems are alike and how they are different. Students should highlight or circle similarities and underline differences.
3. Ask a few students to share their thinking with the class. Listen for students who mention multiplication and division and how they are related to each other.

Answer Key for Compare and Connect:

They are the same because all of the numbers in the problems are the same and the problems are all about equal groups (teams). They are different because different operations are used to solve each of these problems. In multiplication, objects are already in equal groups, but in division, objects need to be split into equal groups.

BUILD (40 min)

What Is Left? (15 min)

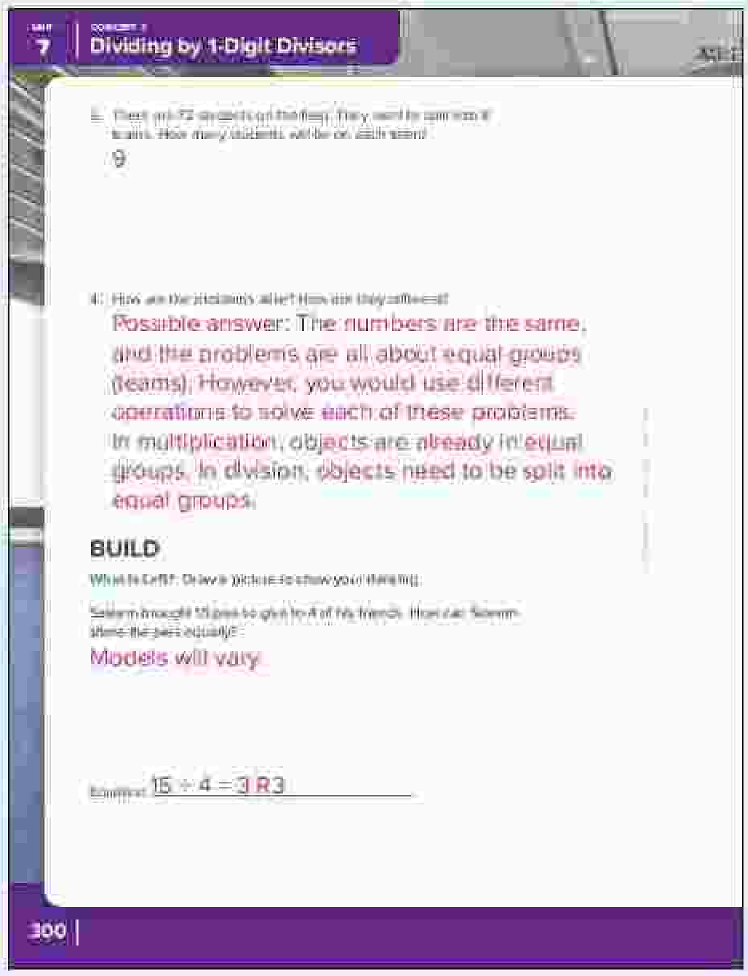
1. Tell students that they are turning from multiplication to division. However, since multiplication and division are related, they will use multiplication to build understanding of division.
2. Direct students to Lesson 10 BUILD What Is Left? Ask students to solve the problem on their own. Ask them to draw a picture or write an equation to show their thinking. They will discover that they have a left-over amount (remainder).
3. Ask students to share their answers with their Shoulder Partner. Invite a volunteer to draw their solution on the board.
4. Write 15 ÷ 4 = 3 R3 on the board and ask students to record it in their Student Edition.
5. Ask students what the numbers in the equation represent in the problem. Label the numbers in the equations with the correct vocabulary word.
   - 15 is the dividend. The dividend is the number out of total objects being divided in the problem.
   - 4 is the divisor. The divisor is the number of equal groups or the number in each group.
   - 3 is the quotient. The quotient is the answer to a division problem.
   - The second 3 is the remainder. The remainder is the quantity left over once all objects have been shared equally. One way to record a remainder is to write R and the number.
6. Ask students to discuss how they could have used the multiples of 4 to solve this problem. Ask, 4 times what number gets you close to 15 without going over? Explain that knowing about multiples and using multiplication facts will help students solve division problems.

Answer Key for What Is Left?

1. 15 ÷ 4 = 3 R3

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UNIT 7 | Dividing by 1-Digit Divisors

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Possible answer: The numbers are the same, and the problems are all about equal groups (teams). However, you would use different operations to solve each of these problems. In multiplication, objects are already in equal groups. In division, objects need to be split into equal groups.

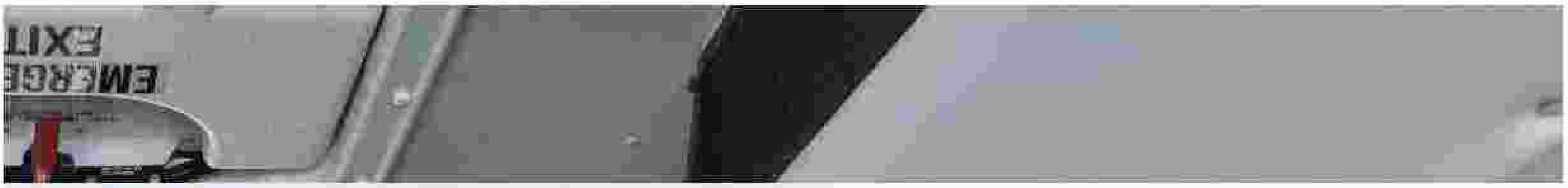
BUILD

Models will vary.

15 ÷ 4 = 3 R3

300

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Zamalek Island

Form of Transportation	How Many People Can Fit on Each	Equation
Microbus	9	32 ÷ 9 = 3 R 5
Motorbike	2	32 ÷ 2 = 16
Car	4	32 ÷ 4 = 8
Van	7	32 ÷ 7 = 4 R 4

Possible answers: The group should take microbuses because they would need fewer vehicles. The group should take cars because no one is left over.

Lesson 10: Exploring Remainders | 301

Getting to Zamalek (25 min)

1. Direct students to the transportation chart in Lesson 10 BUILD Getting to Zamalek. Read the directions and the problem with students.
2. Assign students to small groups. Ask students to work with their group to determine how many people can travel using each form of transportation. Students should write equations, but may also draw pictures to support their thinking. (Students will discover that some of the forms of transportation will leave a remainder of people behind.)
3. Once students write a division equation for each form of transportation, students should make a recommendation, based on their work, about which form of transportation the group should take to their event.
4. Engage students in a whole group discussion about the remainder. Ask students to work with their groups to decide whether people do not go to Zamalek or they increase the number of vehicles needed.
5. Ask students to share their recommendations with the class. Encourage students to use the vocabulary they have learned related to division.

Answer Key for Getting to Zamalek:

Microbus: 32 ÷ 9 = 3 R5

Motorbike: 32 ÷ 2 = 16

Car: 32 ÷ 4 = 8

Van: 32 ÷ 7 = 4 R4

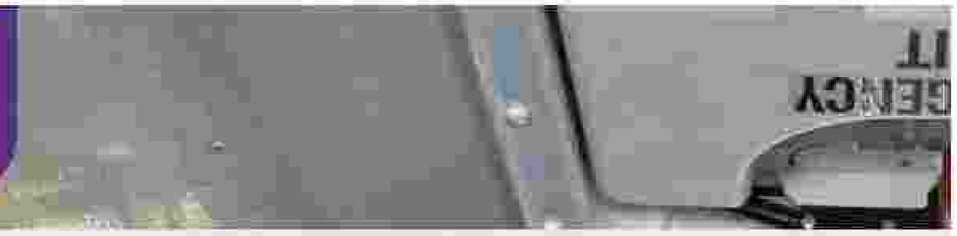
Possible answers: The group should take microbuses because they would need fewer vehicles. The group should take cars because no one is left over.

CONNECT (5 min)

Going to a Swim Meet

Direct students to Lesson 10 CONNECT Going to a Swim Meet. Ask students to read and solve the problem.

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TEACHER NOTE: This problem is designed to get students to think about what happens to the remainder in a real-life problem. They should think about how many buses they will need so that everyone can get to the meet.

Answer Key for Going to a Swim Meet:
Two buses will be needed, but there will be empty seats in the second bus.

WRAP-UP (5 min)

Let's Chat About Our Learning

1. Ask a few students to share their strategies for solving this problem. Make sure to ask students to share their reasoning. If students suggest $1\frac{1}{2}$ buses, be sure to discuss the real-world implications of that answer.
2. Write $60 \div 40 = 1$ R20 on the board. Ask students to identify the dividend, divisor, quotient, and remainder with a different partner.

PRACTICE

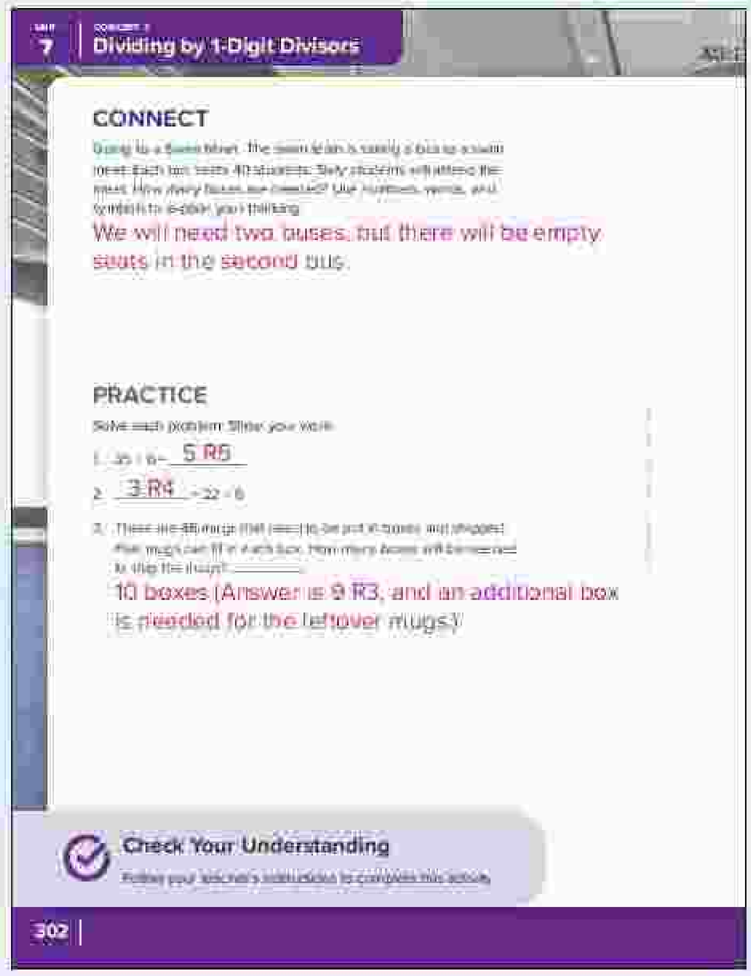
Direct students to Lesson 10 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

1. $50 \div 6 =$ 8 R2
   $90 \div 10 =$ 9
   9 R 1 $= 19 \div 2$
2. Mila walked 12 kilometers. Her sister walked 3 times as many kilometers as Mila. How many kilometers did her sister walk?
   I would solve this problem using: multiplication
3. Ahmed has 40 dates. He wants to give them to 6 of his friends. How many dates will each of his friends get if he shares them equally? Will he have any left over?
   $40 \div 6 = 6$ R 4. Each friend will get 6 dates and Ahmed will have 4 left over.

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UNIT 7 | CONCEPT 2
Dividing by 1-Digit Divisors

CONNECT

We will need two buses, but there will be empty seats in the second bus.

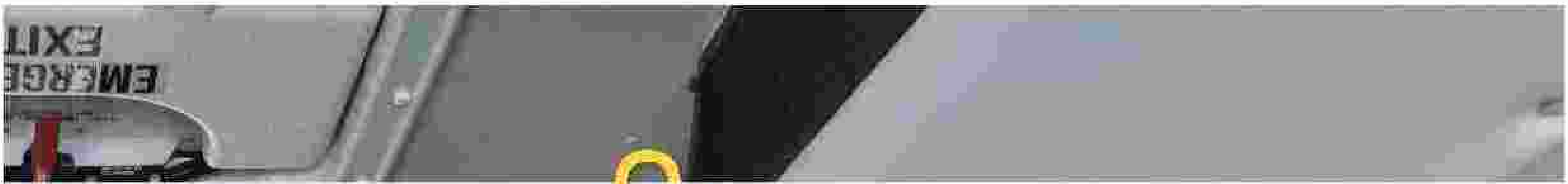
PRACTICE

1. 5 R5
2. 3 R4
3. 10 boxes (Answer is 9 R3, and an additional box is needed for the leftover mugs.)

Check Your Understanding

302

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LESSON 11
Patterns and Place Value in Division

Lesson Overview

In this lesson, students expand on their understanding of division and how it is related to multiplication. They utilize their knowledge of place value and look for patterns as they divide multiples of 10, 100, and 1,000 by one-digit divisors.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?

Learning Objective

In this lesson

- Students will use place value, multiplication facts, and patterns with zeros to divide multiples of 10, 100, and 1,000 by one-digit divisors.

Grade-Level Standard

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

Vocabulary Check-In

dividend, divisor, quotient, remainder

Materials List

- Lesson 11 Number Cards (6–25) (1 set per pair of students)
- Six-Sided Number Cube (1 per pair of students)
- Scissors (1 per pair of students)
- Crayons
- Graph paper (1 per student)

Preparation

Photocopy the Blackline Master at the end of the volume.

Photo Credit: Leonid Andronov / Shutterstock.com

DIGITAL



Lesson 11
Patterns and Place Value in Division

Quick Code
egmt4043

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may only look at the place with the highest value and try to divide. For example, with $2{,}400 \div 3$, they may try to solve $2 \div 3$ instead of $24 \div 3$.
- Students may be confused by how many zeros to put in a quotient, especially when the related fact includes a zero. For example, the related fact for $2{,}000 \div 4$ is $20 \div 4 = 5$. The quotient is 500 since there are two other zeros in the dividend.

Division Array Game

1. Direct students to Lesson 11 Division Array Game. Distribute a set of Number Cards 6–25 to students and give them time to cut the cards apart. As students are cutting, assign them to partners (or have them work with their Shoulder Partners).
2. Explain to students that they are playing a game to help them learn about division. In the game, they create arrays to show division problems. Some of the problems may have remainders—what is left over after objects have been divided evenly.

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LESSON 11

Patterns and Place Value in Division

Quick Code

Learning Target

- I can use place value, multiplication facts, and patterns with zeros to divide multiples of 10, 100, and 1,000 by one-digit divisors.

ACCESS

Division Array Game

Follow the instructions to create arrays to show division problems.

Materials per two players

- Number cards 6–25
- One 6-sided number cube
- One piece of graph paper

Objective of the game

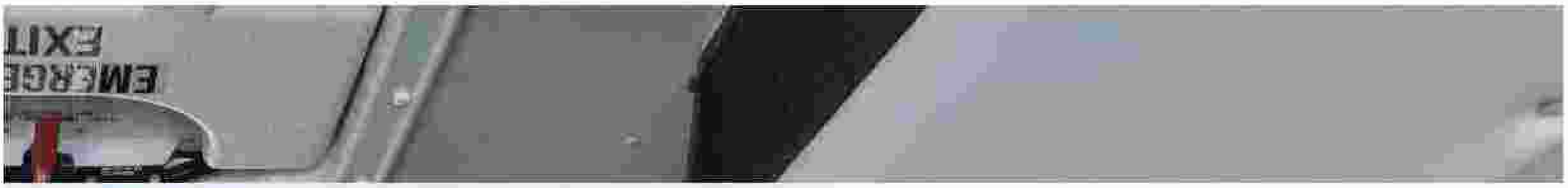
- To have the highest total score

Directions

1. Shuffle the number cards. Place the deck with the numbers facing down on the table.
2. Player A draws a number card. This number becomes the dividend.

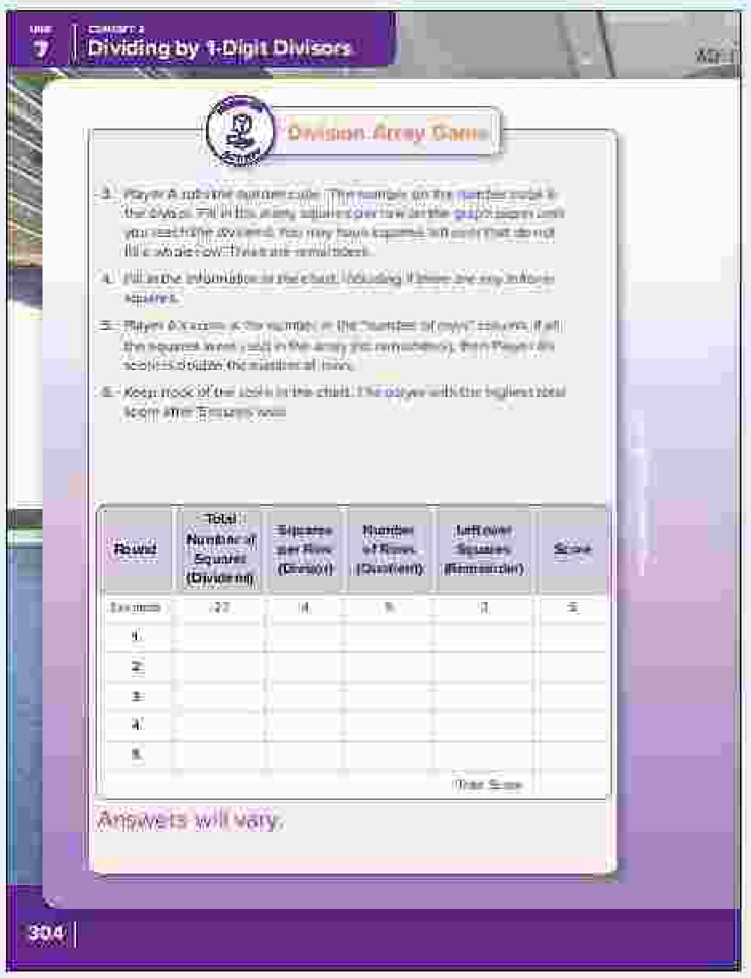
Lesson 11: Patterns and Place Value in Division | 303

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3. Model how to play the game for students. (See Example for Player for additional information on how to shade quotients on the graph paper.)
    - Put the two number card decks together and shuffle them. Place the deck face down on the table.
    - Player A draws a number card. This number becomes the dividend.
    - Player A then rolls the number cube. The number on the number cube is the divisor.
    - Fill in the rolled number of squares per row on the graph paper until you reach the dividend. You may have squares left over that do not fill a whole row. These are the remainders.
    - Fill in the information in the table.
    - Player A's score is the number in the "Number of Rows" column. If all the squares were used in the array (no remainders), then Player A's score is DOUBLE the number of rows.
    - Keep track of the score in the table. The player with the highest total score after 5 rounds wins.

Example for Player A: Draws a 21. Rolls a 6. Player shades in 6 squares in each row until they reach 21. 3 completed rows = 3 points.

1	2	3	4	5	6				
7	8	9	10	11	12				
13	14	15	16	17	18				
19	20	21							

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BUILD (40 min)

Division Patterns

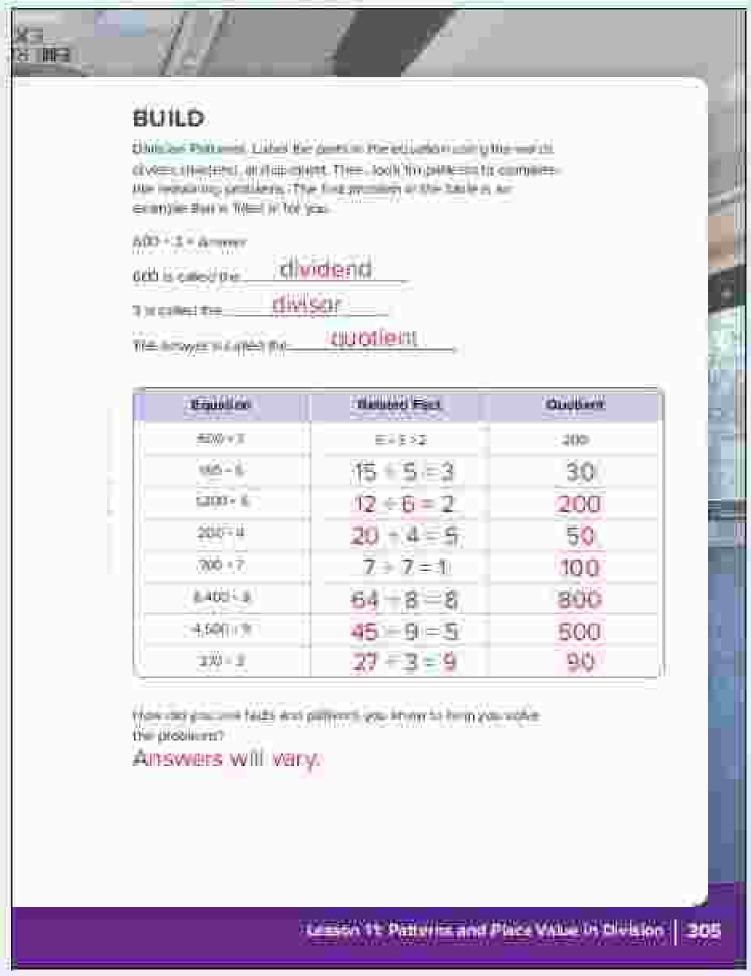
1. Direct students to Lesson 11 BUILD Division Patterns and ask them to draw lines from each part of the equation to the term that describes it.
   600 is the dividend, 3 is the divisor, and 200 is the quotient.
2. Explain to students that since 600 is such a large number and it is a multiple of 100, that they can use a related fact of 6 ÷ 3 and the patterns they have learned related to 10s, 100s, and 1,000s to solve the problem.
3. Write 6 ÷ 3 = 2 on the board and relate this back to the multiplication facts 3 × 2 = 6 and 2 × 3 = 6. Ask students how they could apply their knowledge of patterns with zeros to solve the problem.
   Students should recognize that 2 × 3 is 6, 20 × 3 is 60, and 200 × 3 is 600.
4. Explain to students that they should use the table to think of related facts they can use to solve the problem. Students may work independently or with a partner to complete the table. If students are struggling, work with the whole class to complete some of the problems.
5. Once students have completed the table, ask them to respond to the reflection question. After a few minutes, ask students to share their ideas. Make sure students recognize that the number of zeros in the dividend is the same as the number of zeros in the quotient unless the related fact has a zero in it.

Answer Key for Division Patterns:

Equation	Related Fact	Quotient
600 ÷ 3	6 ÷ 3 = 2	200
150 ÷ 5	15 ÷ 5 = 3	30
1,200 ÷ 6	12 ÷ 6 = 2	200
200 ÷ 4	20 ÷ 4 = 5	50
700 ÷ 7	7 ÷ 7 = 1	100
6,400 ÷ 8	64 ÷ 8 = 8	800
4,500 ÷ 9	45 ÷ 9 = 5	500
270 ÷ 3	27 ÷ 3 = 9	90

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Student Page 305



BUILD

[illegible]

dividend

divisor

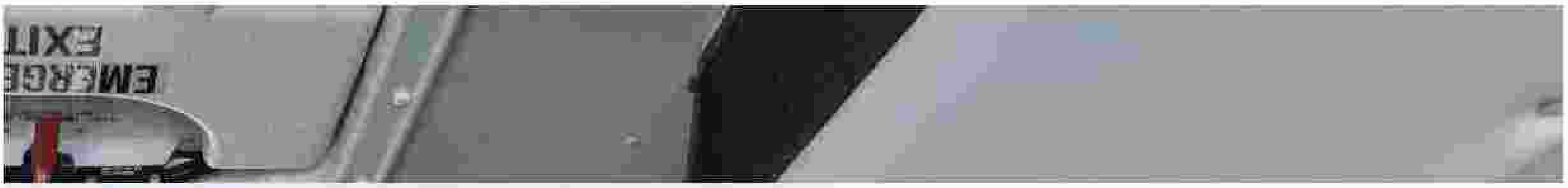
quotient

Equation	Related Fact	Quotient
[illegible]	[illegible]	[illegible]
[illegible]	15 ÷ 5 = 3	30
[illegible]	12 ÷ 6 = 2	200
[illegible]	20 ÷ 4 = 5	50
[illegible]	7 ÷ 7 = 1	100
[illegible]	64 ÷ 8 = 8	800
[illegible]	45 ÷ 9 = 5	500
[illegible]	27 ÷ 3 = 9	90

Answers will vary.

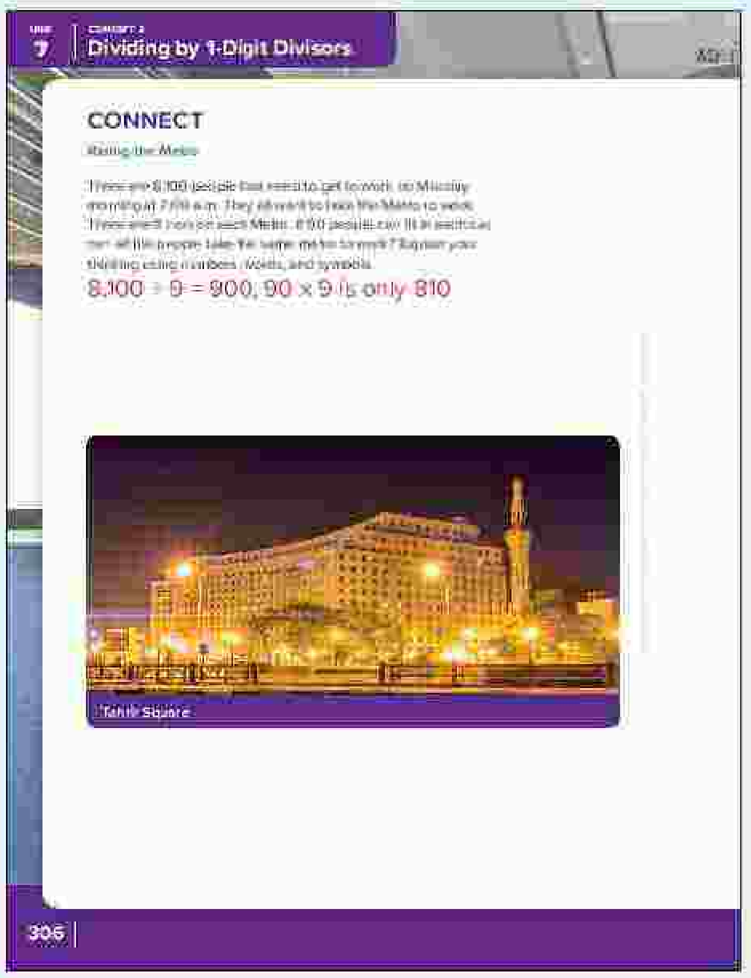
Lesson 11: Patterns and Place Value in Division | 305

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CONNECT (7 min)

Riding the Metro

Direct students to Lesson 11 CONNECT Riding the Metro and ask them to solve the problem.

TEACHER NOTE: This activity is a great opportunity for formative assessment related to students' progress toward the concept's Learning Targets.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share the strategies they used to solve the problem in CONNECT. Listen for strategies that include place value and patterns with zeros.

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PRACTICE

Direct students to Lesson 11 PRACTICE and have them complete the problems. Address student errors and misconceptions.

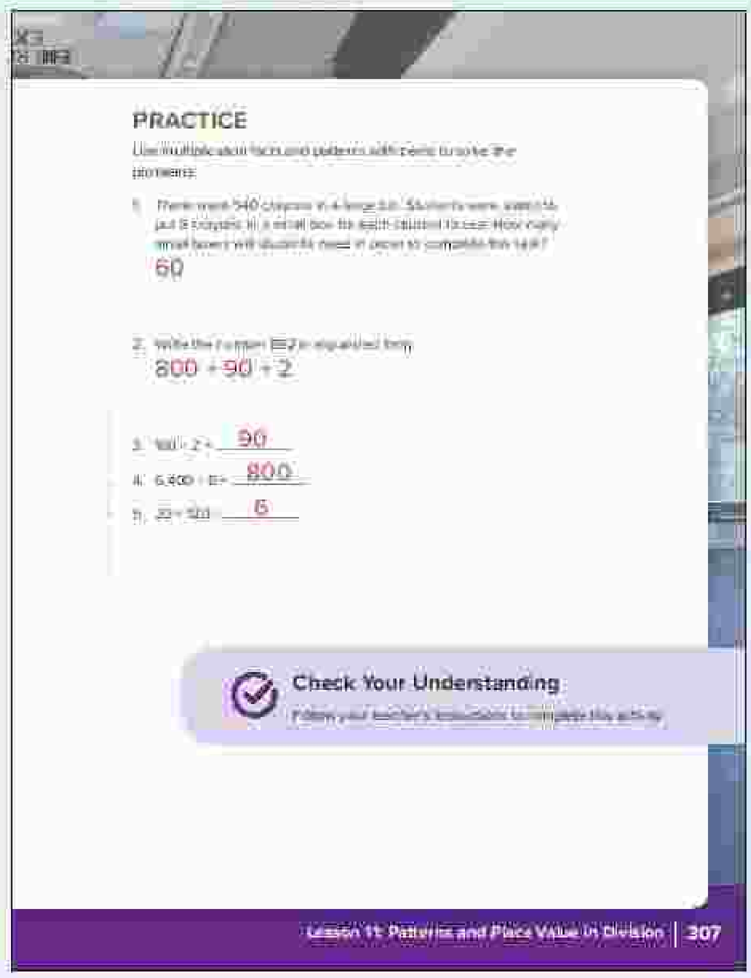
Check Your Understanding

Use multiplication facts and patterns with zeros to solve the problems.

1. Malik wanted to make falafel. He bought 360 grams of fava beans at the store. He read he would need about 6 grams of fava beans per falafel patty. How many falafel patties can he make using all of his beans?
   360 ÷ 6 = 60 falafel patties
2. 4,500 ÷ 5 = 900
3. 630 ÷ 7 = 90
4. 400 = 3,200 ÷ 8
5. 630 ÷ 9 = 70

PRINT

Student Page 307





LESSON 12
The Area Model and Division

Lesson Overview

In this lesson, students learn how to use the area model to solve division problems. Students gained familiarity with the area model strategy when learning about multiplication. Applying the strategy to solve division problems helps to reinforce the relationship between multiplication and division. Students should continue to look for patterns and place value relationships to solve problems.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will use area models to represent and solve division problems.

Grade-Level Standards

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.A.2.e Illustrate and explain calculations using equations or models.

Vocabulary Check-In

area model, dividend, divisor, quotient, remainder

Materials List

- Unit 7 Lesson 12 Target Number Cards (1 set of cards per group)

Preparation

Photocopy and cut apart the Blackline Master at the end of the volume.

Photo Credit: Adwo / Shutterstock.com

DIGITAL



Lesson 12
The Area Model and Division

Quick Code:
egmt4044

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may get confused with how many zeros to place at the end of a product. For example, students may write $7 \times 3{,}000 = 2{,}100$ instead of $7 \times 3{,}000 = 21{,}000$. Students may also write $4 \times 500 = 200$ instead of $4 \times 500 = 2{,}000$.
- Students may have difficulty determining which multiples to use to start decomposing a dividend when using an area model. It is most effective and efficient to start with multiplying the divisor by 10, 100, or 1,000. For example, for $256 \div 8$, it is helpful to begin with $8 \times 10 = 80$ and to work up to 256.

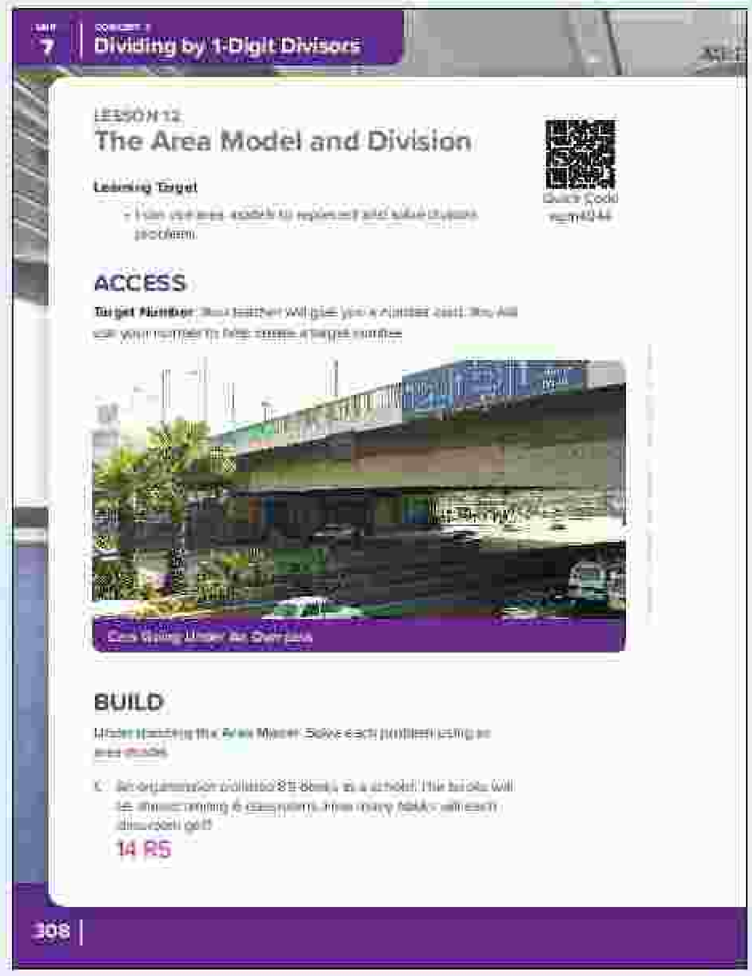
Target Number

1. Divide students into small groups of four or five and distribute a set of Target Number Cards to each group.
2. Explain to students that the cards contain numbers that will be combined in different ways to create a "target number." When the target number is given, their group should work together to find cards that combine to create the target number. For example, if the target number is 100, students could use cards 50, 40, and 10. If students finish early, they can use the remaining cards to find a different combination of numbers.
3. Write 50 on the board. This is the first target number. Observe students as they work together to find cards that add up to 50.

   TEACHER NOTE: Some students may not fit into any group in a given round. That is okay. Have students go back to their seats if their numbers are not in use during this round.
4. Ask a few groups to share their combinations and record them on the board. For example, you may have one group that made 50 by putting together $20 + 20 + 5 + 5$ and another that used $30 + 10 + 10$.
5. Repeat with two to three different target numbers that are multiples of 5 or 10.

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Student Page 308


UNIT 7 | CONCEPT 2 Dividing by 1-Digit Divisors

LESSON 12

The Area Model and Division

Learning Target

ACCESS

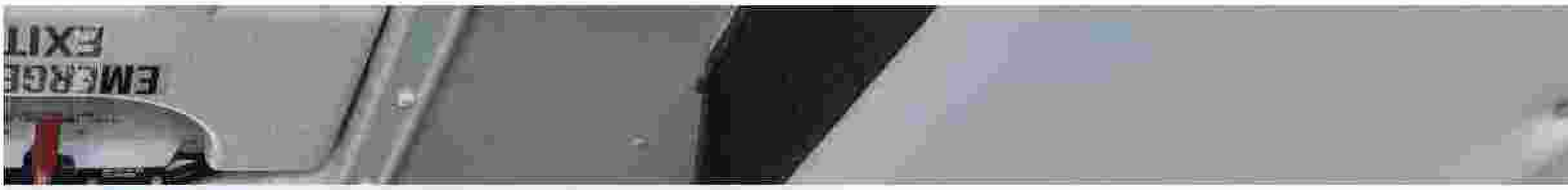
Target Number

Cars Going Under An Overpass

BUILD

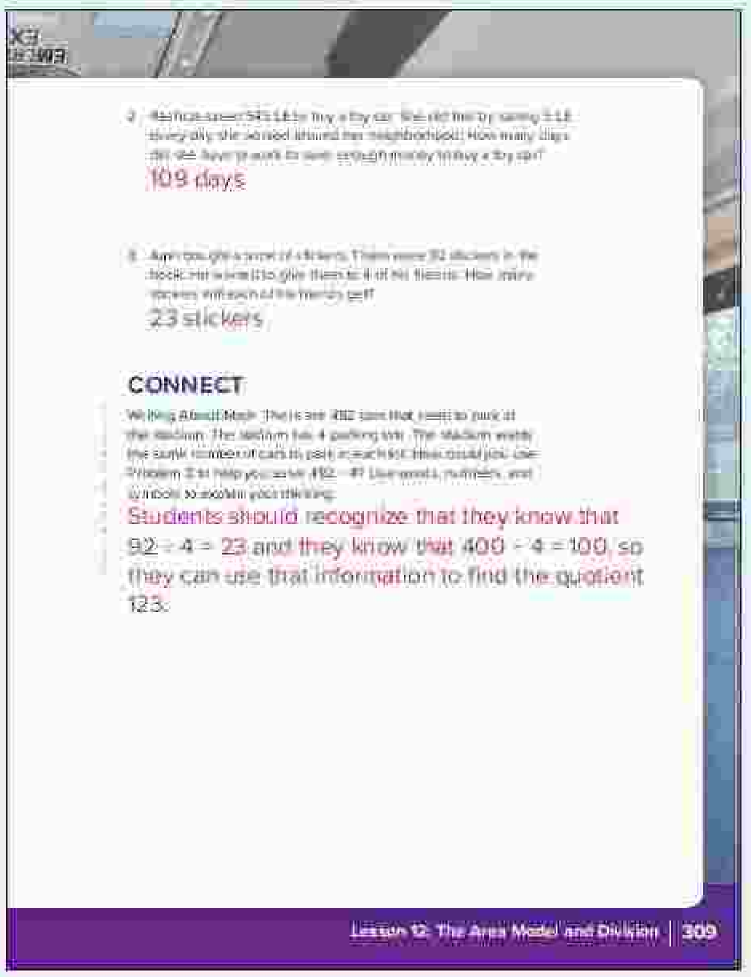
14 RS

308



PRINT

Student Page 309



109 days

23 stickers

CONNECT

Students should recognize that they know that $92 \div 4 = 23$ and they know that $400 \div 4 = 100$, so they can use that information to find the quotient 123.

Lesson 12: The Area Model and Division | 309

BUILD (40 min)

Understanding the Area Model

1. Direct students to Lesson 12 BUILD Understanding of the Area Model and ask them to read Problem 1 silently.

2. Ask students to Turn and Talk about whether each classroom could get 10 books. Listen for students who say classrooms will receive more than 10 books because 6×10 is only 60.

3. Ask students to Turn and Talk about whether each classroom could get 15 books. Listen for students who say that each classroom cannot get 15 books because 6×15 is 90, which is more than 89.

4. Write $89 \div 6 =$ _______ on the board. Ask students to identify the dividend and the divisor in the problem. In this problem, the divisor represents how many classes will receive books (or the number of equal groups that must be created).

5. Tell students that today they will learn how to use an area model for division. To begin, they will decompose the dividend into multiples of the divisor.

6. Draw a long rectangle on the board and write 6 on the left side of the box.

6	

7. Ask students how many books would be used if each classroom got 10 books. Since 6×10 is 60, remind students that 60 is a multiple of 6 which is the divisor in this problem. Draw a vertical line inside the rectangle. Write $6 \times 10 = 60$ inside the section of the model and 10 underneath.

6	$6 \times 10 = 60$	
	10	

8. Explain to students that they have just divided up 60 of the 89 books. Ask students how many books are left to divide and if they can make more groups of 6. Ask students to talk to their Shoulder Partner. $(89 - 60 = 29)$

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9. Do a Think Aloud to model your thought process for students.
   - There are 29 books left to divide.
   - I know that 6 × 5 = 30, which is too much. 6 × 4 = 24.
10. Write 6 × 4 = 24 inside the empty section of the model and 4 underneath. Since there are not enough to make another group of 6, there is a remainder. Write 5 outside the rectangle.

6	6 × 10 = 60	6 × 4 = 24
	10	4

11. Continue to do a Think Aloud.
   - I know that 60 + 24 = 84, so that means I have 5 books left over. I can record the remainder next to the area model.

6	6 × 10 = 60	6 × 4 = 24	
	10	4	R5

12. Explain to students that they have decomposed 89 into 60 + 24 + 5. Circle those numbers in the area model and ask students to confirm that the sum of those numbers is 89.
13. Ask students if they know how many books each classroom will get. Allow time for discussion. Explain (or confirm) that in order to find the quotient, we must add the numbers that were multiplied by 6 – 10 and 4. So, each class will get 14 books.
14. Reread the question. Ask students what the answer to this problem means and what the remainder means.
    It means that each class can get 14 books and that there are 5 books left over that cannot be shared evenly among the classes.
15. Allow students to copy the area model and solution for Problem 1 into their Student Edition.
16. Read the next problem as a group. Ask students to work with a partner or small group to solve the problem using the area model. After most students are finished, go over the answer together. Ask students to help you create an area model on the board. Remind students that there are different ways to decompose 545. However, every group should be using the same divisor—5. Different groups may try different approaches.

    TEACHER NOTE: It is important to note that there are a number of acceptable ways decompose the dividend when using this method. The important thing is that students are recording all their work. As you walk around the room, take note of the different ways students decomposed 545. Make sure they are writing the factors they multiplied by 5 to get their multiple.

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17. Ask a few groups to share how they created their area model on the board. (One possible decomposition of 545 is shown.)

5	5 × 100 = 500	5 × 9 = 45
	100	9

500 + 45 = 545 (no remainder)

100 + 9 = 109 days

18. Ask students to Turn and Talk with their Shoulder Partner about what they notice about the different solution strategies. If time allows, ask students to share their thinking with the class.

19. Ask students to try the remaining problem on their own. Go over the final answer together.

4	4 × 20 = 80	4 × 3 = 12
	20	3

80 + 12 = 92 (no remainder)

20 + 3 = 23 stickers

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 12 CONNECT Writing About Math and ask them to respond to the prompt.

TEACHER NOTE: Consider using this task as a formative assessment to determine whether students are able to identify patterns and relationships and use them to solve problems.

Answer Key for Writing About Math:

Students should recognize that they know that $92 \div 4 = 23$ and they know that $400 \div 4 = 100$, so they can use that information to find the quotient 123.

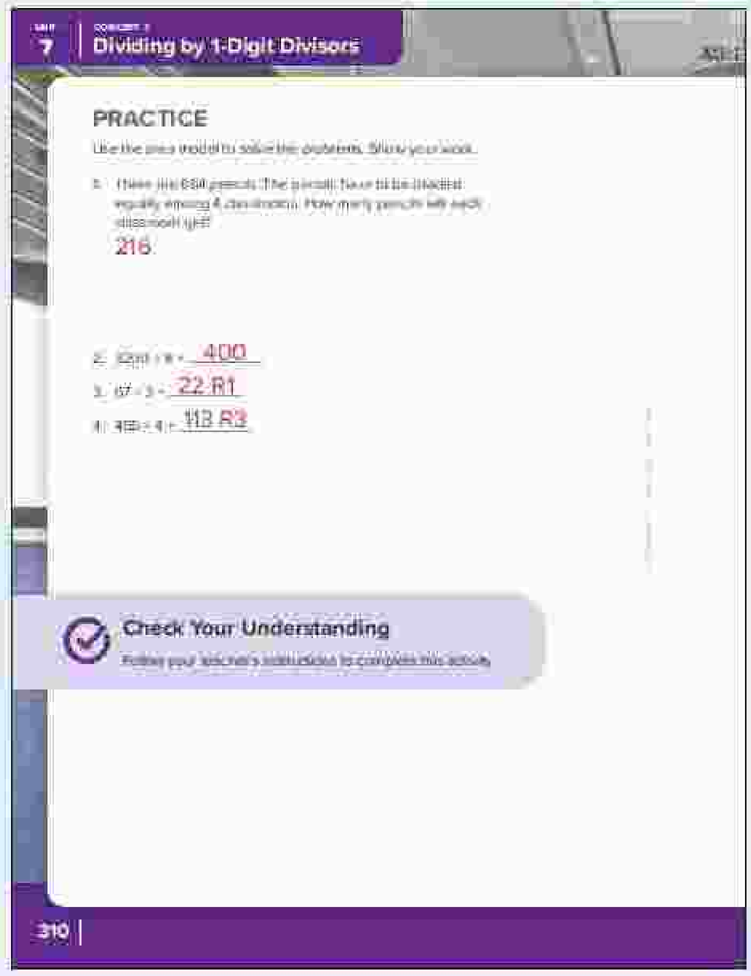
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share what they notice and wonder about the area model. Encourage students to ask questions, especially if you have noticed that some students are struggling to decide how to decompose the dividend.

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Student Page 310


UNIT 7 | Dividing by 1-Digit Divisors

PRACTICE

Use the area model to solve the problems. Show your work.

1. 216

2. 400

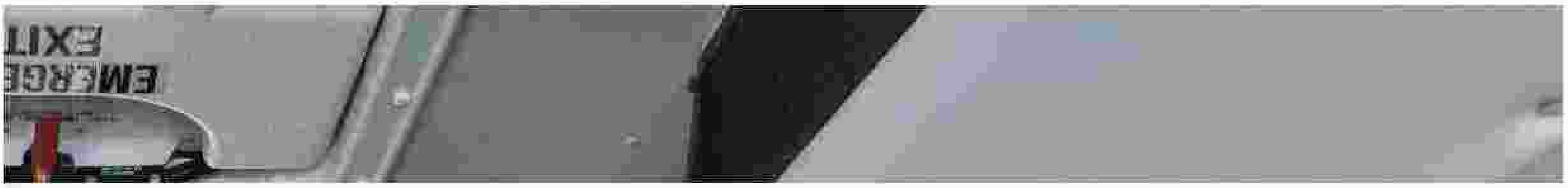
3. 22 R1

4. 113 R3

Check Your Understanding

310

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PRACTICE

Direct students to Lesson 12 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve division problems using an area model.

Possible area models are shown. Students may choose to decompose the dividend in different ways, but all students should get the same quotient.

1. Nashwa saved 868 coins last year. She wanted to put them into 8 jars. How many coins will go in each jar?

   108 with 4 left over; 108 R4

8	$8 \times 100 = 800$	$8 \times 8 = 64$	
	100	8	R4

   $800 + 64 = 864 + 4 = 868$

   $100 + 8 = 108$ R4

2. $810 \div 9 = 90$

9	$9 \times 90 = 810$
	90

   $9 \times 90 = 810$ (no remainder)

3. $93 \div 4 = 23$ R1

4	$4 \times 20 = 80$	$4 \times 3 = 12$	
	20	3	R1

   $80 + 12 = 92 + 1 = 93$

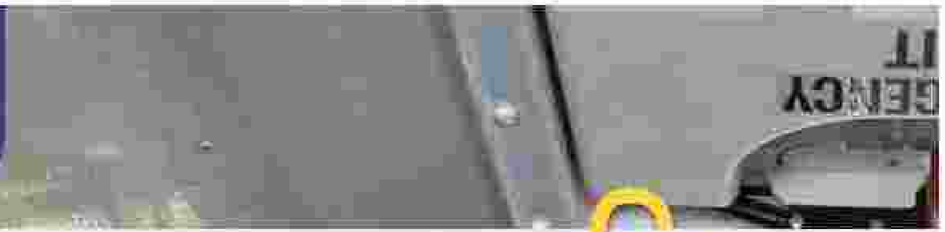
   $20 + 3 = 23$ R1

4. $250 \div 3 = 83$ R1

3	$3 \times 80 = 240$	$3 \times 3 = 9$	
	80	3	R1

   $240 + 9 = 249 + 1 = 250$

   $80 + 3 = 83$ R1



LESSON 13
The Partial Quotients Algorithm

Lesson Overview

In this lesson, students use the partial quotients algorithm to divide by one digit. As in previous lessons, students are asked to make connections between prior knowledge and new information to support their learning. Students use multiplication facts, place value, and patterns in zeros in multiplication to solve and explain division problems.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objective

In this lesson

- Students will use the partial quotients algorithm to divide dividends with up to four digits by one-digit divisors.

Grade-Level Standards

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.A.2.e Illustrate and explain calculations using equations or models.

Vocabulary Check-In

partial quotients algorithm

Materials List

No additional materials needed

Preparation

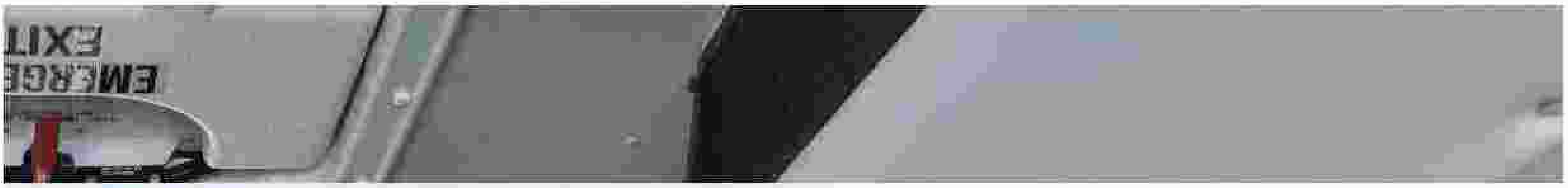
No additional preparation needed

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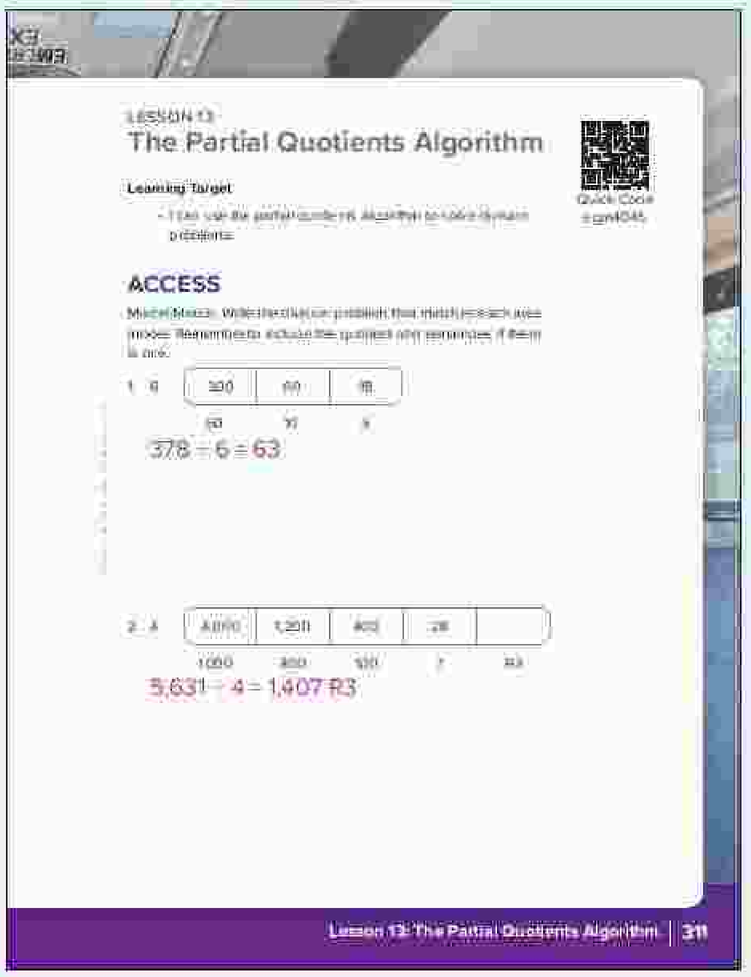
Lesson 13
The Partial Quotients Algorithm

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LESSON 13

The Partial Quotients Algorithm

Learning Target

Quick Code

ACCESS

1. 6

300	60	18
50	10	3

378 ÷ 6 = 63

2. 4

4,000	1,200	400	28	
1,000	300	100	7	R3

5,631 ÷ 4 = 1,407 R3

Lesson 13: The Partial Quotients Algorithm | 311

ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have difficulty determining which multiples to use to start decomposing a dividend when using area models or the partial quotients algorithm. For those students, it may be helpful for them to start by multiplying the divisor by 10, 100, or 1,000. For example, for 7,236 ÷ 6, it is helpful to begin with 6 × 1,000 = 6,000 and then multiply by 10 or 100 until the dividend has been divided evenly.

Model Match

1. Direct students to Lesson 13 ACCESS Model Match. Read the directions with students and give students time to write equations that match the area models. Remind students to include the quotient and the remainder.
2. Remind students that there is more than one way to decompose a dividend when using an area model for division. If time allows, ask students for another way to decompose 5,631.
   Possible answers include 2,000 + 2,000 + 1,600 + 20 + 8 + 3

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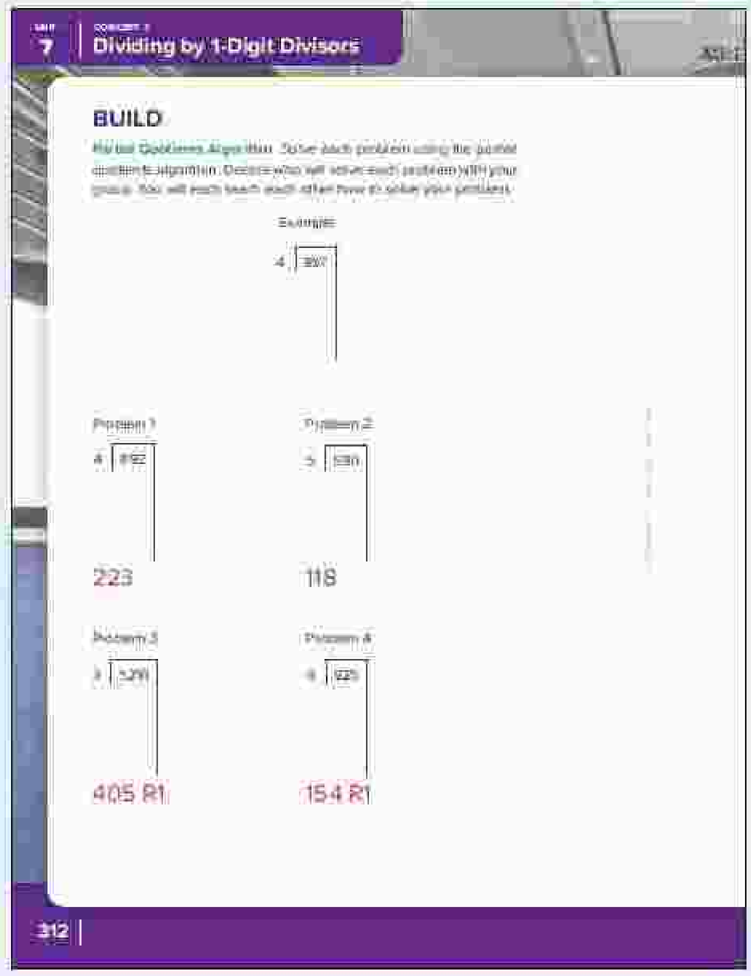
BUILD (45 min)

Partial Quotients Algorithm

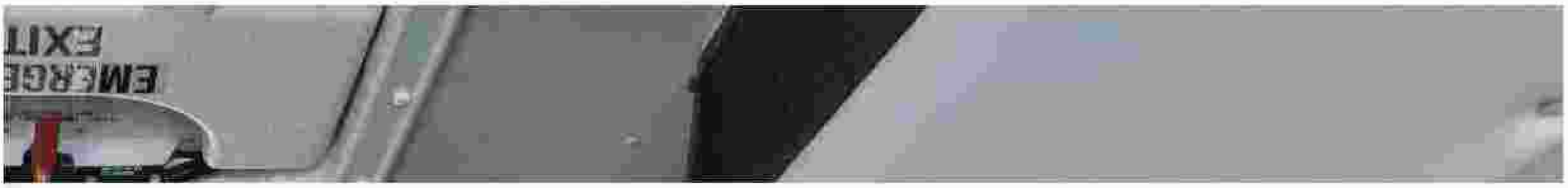
1. Write $4 \times 5 = 5 + 5 + 5 + 5$ on the board. Ask students to discuss what this equation means. If necessary, explain that it shows that multiplication is repeated addition. Ask the following question and allow students to discuss:
   - If multiplication is the same as repeated addition and division is the opposite of multiplication, what does that tell us about division?
2. If necessary, explain that another way to think about division is as repeated subtraction.
3. Write $42 \div 6$ on the board. Ask students how they could use subtraction to solve this problem. If students need help getting started, write $42 - 6 = 36$. Keep subtracting 6 until there is nothing left to subtract. Show students that they could subtract 7 groups of 6.
   $42 - 6 = 36 - 6 = 30 - 6 = 24 - 6 = 18 - 6 = 12 - 6 = 6 - 6 = 0$
   1 2 3 4 5 6 7
4. Explain to students that subtraction will be important in the division strategy they work on today. Write "partial quotients" on the board.
5. Ask students to turn to their Shoulder Partner to discuss what comes to mind when they think about the words "partial quotients." Ask students to share their ideas with the class.
   Listen for students who mention that partial is related to the word part, that the quotient is the answer to a division problem, and that students learned the partial products algorithm for multiplication.
6. Direct students to Lesson 13 BUILD Partial Quotients Algorithm. Write the problem $4\overline{)897}$ on the board. Explain to students that this is another way of writing a division problem. The dividend goes underneath the line and the divisor goes to the left of the symbol.

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7. Draw a line down the far right side of their equation.

   $4\overline{)897}\,|$

8. Look at the dividend. Ask students what the 8 in the dividend represents. (800) Ask students if there is a multiple of 4 that helps them solve 800 divided by 4.

   Students should recognize 4 × 2 = 8. Some may note that 4 × 20 = 80 or that 4 × 200 = 800.

   TEACHER NOTE: When students are solving these problems independently, they can start with whatever multiple makes sense to them. If they want to start this problem with 400 because 4 × 100 = 400, that is accurate, too.

9. Show students how to write the part of the quotient (200) on the right side of the line.

   $4\overline{)897}\,|\,200$

10. Ask students to confirm that 4 × 200 is 800. Write 800 under the dividend and subtract from 897.

$$\begin{array}{r|l} 4\overline{)897} & 200 \\ \underline{-\,800} & \\ 97 & \end{array}$$

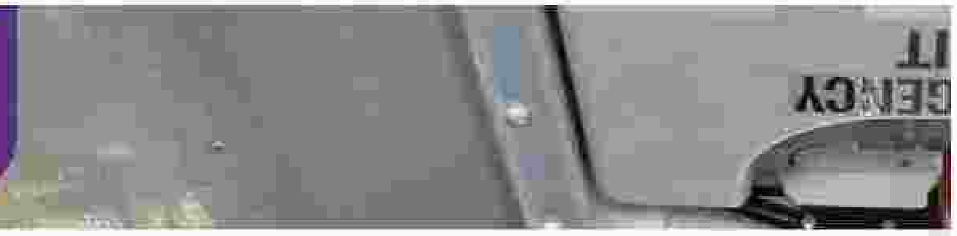
11. Ask students to look at the 97 that is left. Ask students to turn to their Shoulder Partner and discuss a multiple of 4 that is close to 97. (Students may say 80, 88, or 96, all of which are accurate.) Remind students that there are multiple ways to decompose numbers. Write 10 as part of the quotient on the right side of the line.

$$\begin{array}{r|l} 4\overline{)897} & 200 \\ \underline{-\,800} & \\ 97 & 10 \end{array}$$

12. Ask students to confirm 4 × 10 = 40. Write 40 under 97 and subtract. Ask students what is left to divide. (57) Have them talk to their Shoulder Partner about what they could do next.

$$\begin{array}{r|l} 4\overline{)897} & 200 \\ \underline{-\,800} & \\ 97 & 10 \\ \underline{-\;\;40} & \\ 57 & \end{array}$$

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13. Repeat writing 10 as part of the quotient on the right side of the line and writing 40 under 57. Subtract. Ask students to share their thoughts with the group.

```
4|897|200
 −800|
   97|10
 − 40|
   57|10
 − 40|
   17|
```

14. Ask students what multiple of 4 gets them closest to 17. (16) Show students how to write 4 as part of the quotient on the right side of the line and subtract 16 from 17.

```
4|897|200
 −800|
   97| 10
 − 40|
   57| 10
 − 40|
   17|  4
 − 16|
    1|
```

15. Ask students if 4 divides equally into 897.
 They should notice that it does not because there is a remainder of 1.

16. Tell students that they can now find the quotient. Explain that the parts of the quotient are along the right side. They must add all of the partial quotients to get the complete quotient. Remind students to include the remainder as part of the final quotient.
 200 + 10 + 10 + 4 = 224 R1

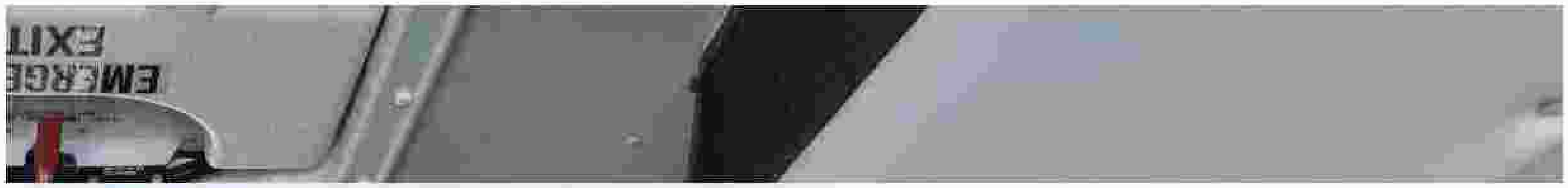
17. Direct students to Lesson 14 Partial Quotients Algorithm and ask them to copy the partial quotients algorithm for 897 ÷ 4 from the board.

18. Divide students into groups of 4. Explain to students that each member of the group will choose one of the four BUILD problems and try to solve it using the partial quotients algorithm. They will then share their work with their group, helping each other learn how to divide using the partial quotients algorithm.

19. Give students about 5 minutes to work. If students are struggling, work together to solve another example on the board.

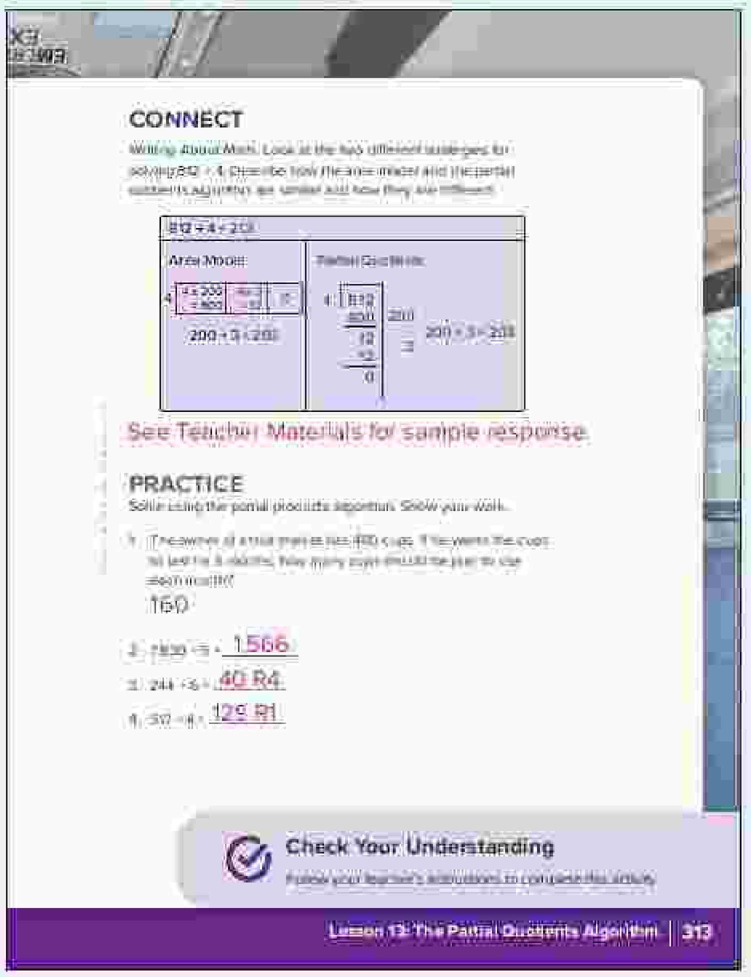
20. At your signal, students should share their work with the other members of their group. Encourage students to ask questions of each other and to help each other practice this strategy.

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CONNECT

Writing About Math: Look at the two different strategies for solving 812 ÷ 4. Describe how the area model and the partial quotients algorithm are similar and how they are different.

812 ÷ 4 = 203

Area Model

200 + 3 = 203

Partial Quotients

200 + 3 = 203

See Teacher Materials for sample response.

PRACTICE

Solve using the partial products algorithm. Show your work.

1. 160

2. 1566

3. 40 R4

4. 129 R1

Check Your Understanding

Lesson 13: The Partial Quotients Algorithm | 313

CONNECT (7 min)

Writing About Math

Direct students to Lesson 13 CONNECT Writing About Math. Ask students to work independently to respond to the prompt.

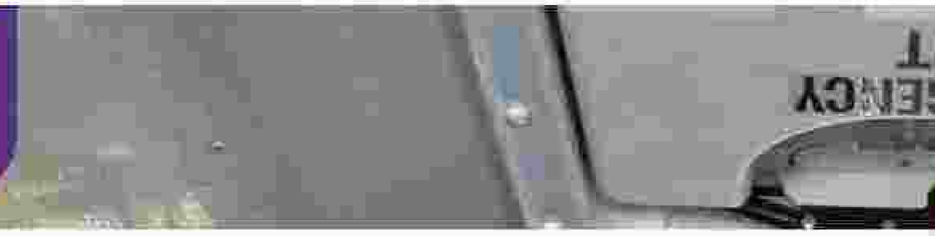
Answer Key for Writing About Math:
Students may recognize that both strategies involve finding parts of quotients and use multiplication, place value, and patterns with zeros. Both strategies allow flexibility in how the dividend is decomposed. Both strategies require students to add partial quotients together to get the final quotient. The strategies are different in how the problems are structured. The area model uses multiplication and addition, while the partial quotients model uses multiplication and subtraction.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their responses to the Writing About Math prompt. Encourage students to ask each other questions.

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PRACTICE

Direct students to Lesson 13 PRACTICE and have them complete the problems. Address student errors and misconceptions.

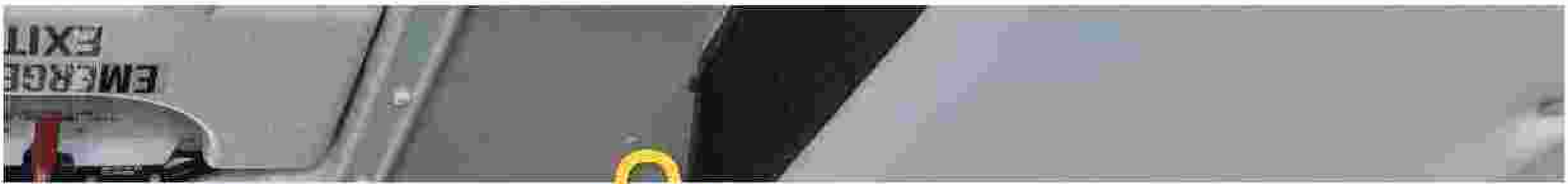
Check Your Understanding

Solve using the partial quotients algorithm.

1. An industrial machine made 1,026 cans of diet sodas and 5 times as many regular sodas over the course of 45 minutes. The regular sodas were then placed into 2 shipping boxes with each shipping box containing the same number of sodas. How many regular sodas were in each shipping box?
   1,026 × 5 = 5,130
   5,130 ÷ 2 = 2,565 sodas

2. 737 ÷ 4 = 184 R 1
   5,724 ÷ 8 = 715 R 4
   792 ÷ 3 = 264

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LESSON 14
The Standard Division Algorithm

Materials List

No additional materials needed

Preparation

No additional preparation needed

Lesson Overview

In this lesson, students are introduced to the standard algorithm for division and make connections to the area model and the partial quotients algorithm. Students use multiplication facts, place value, and patterns in zeros in multiplication to solve and explain division problems. They should recognize that, while all of the strategies they have learned are effective, the standard algorithm is the most efficient once it is mastered.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objectives

In this lesson

- Students will estimate quotients using properties of place value and patterns in multiplication and division.
- Students will use the standard algorithm to solve division problems.

Grade-Level Standards

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

standard algorithm, regroup

DIGITAL



Lesson 14
The Standard Division Algorithm

Quick Code: egmt4046

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

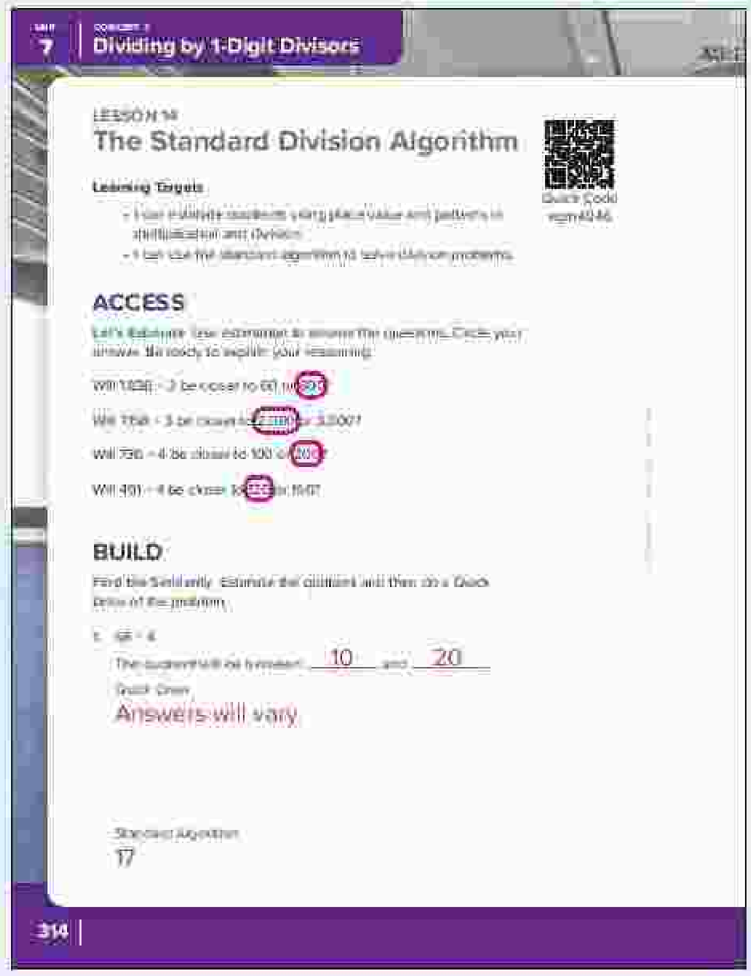
- Students may attempt to start dividing in the Ones place. However, it is important to start dividing in the place with the highest value when using the standard algorithm for division.

Let's Estimate

1. Direct students to Lesson 14 ACCESS Let's Estimate and go over the directions with students. Remind students that estimation is a good way to help decide if an answer is reasonable. Give students time to answer the questions.
2. Ask students to talk to their Shoulder Partner about their estimates. If there is time, discuss a few problems and ask students what makes the estimates reasonable.

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UNIT 7 | Dividing by 1-Digit Divisors

LESSON 14

The Standard Division Algorithm

Learning Targets

ACCESS

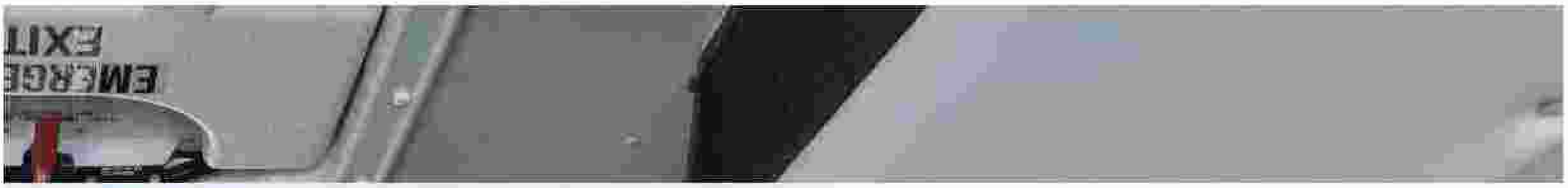
BUILD

The quotient will be between 10 and 20

Answers will vary

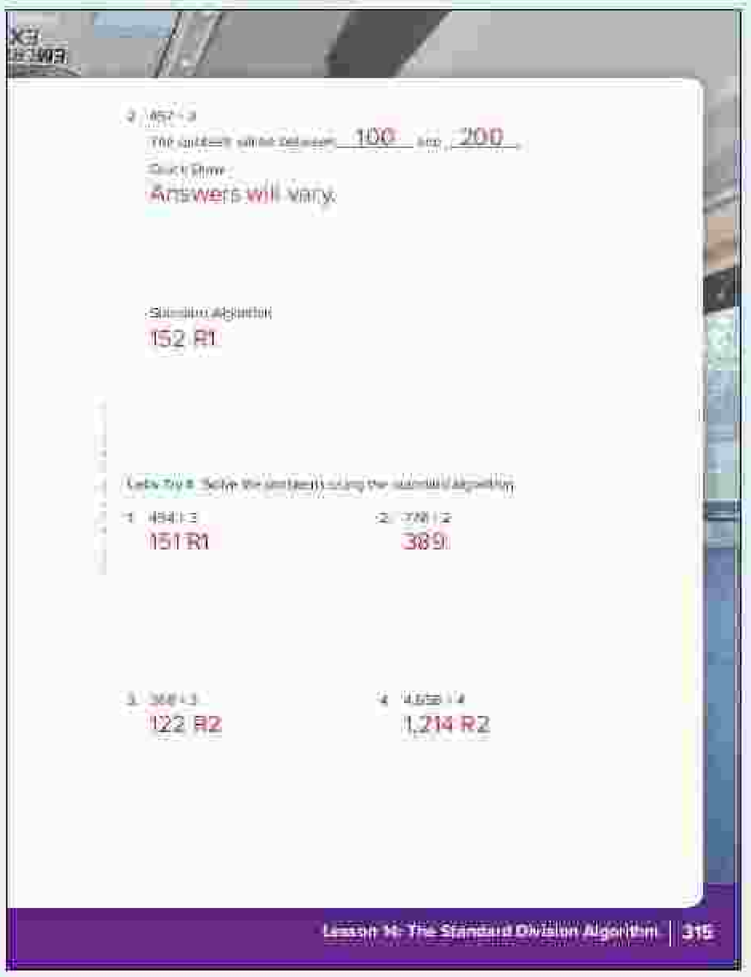
17

314



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Student Page 315



2. 457 ÷ 3

The quotient will be between 100 and 200.

Quick Draw

Answers will vary.

Standard Algorithm

152 R1

Let's Try It: Solve the problem(s) using the standard algorithm.

1. 454 ÷ 3
151 R1

2. 778 ÷ 2
389

3. 368 ÷ 3
122 R2

4. 4,858 ÷ 4
1,214 R2

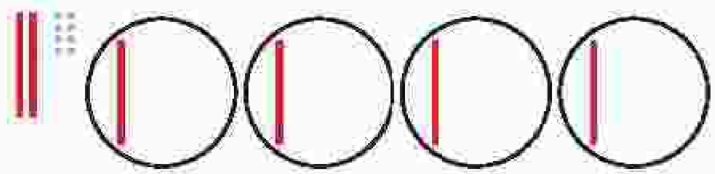
Lesson 14: The Standard Division Algorithm | 315

BUILD (40 min)

Find the Similarity (20 min)

1. Direct students to Lesson 14 BUILD Find the Similarity. Ask students to estimate the quotient of 68 ÷ 4.
Using estimation, the quotient should be between 10 and 20.

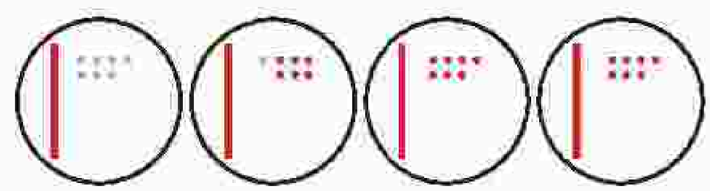
2. Ask students to do a Quick Draw of the problem. Ask students how many Tens they could put in each group so that each group gets the same number of Tens. 1



3. Ask students to Turn and Talk about what they could do with the 2 left over Tens (regroup each Ten into 10 Ones). Now there would be 28 ones.



4. Ask students how many Ones they place in each group (7). Remind students that the quotient in this problem is how many are in each group (17).



5. Explain to students that today they will be learning how to use the standard algorithm for division.

6. Write the following steps on the board: Set Up, Divide, Multiply, Subtract. Leave the steps on the board during the lesson. Model how to solve 68 ÷ 4 using the standard algorithm.

    - Step 1 (Set Up): Set up the problem. The dividend goes under the line and the divisor goes to the left of the division symbol. Remind students that this is another way to set up a division problem.

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- Step 2 (Divide): Start with the digit in the place with the highest value. I know that $6 \div 4$ is 1 with a remainder of 2.
  - Write 1 on top of the line above the 6. Explain that the remainder is not recorded at this time.
- Step 3 (Multiply): Explain that the value of the 1 is 10 because it is in the Tens place. Think 4 times 10 is 40. Write 40 underneath 68. Point out that 40 is the part of the dividend that was just divided.
- Step 4 (Subtract): $68 - 40$ is 28. Record the difference.
- Step 5 (Divide): Explain that 28 is the new dividend. $28 \div 4 = 7$. Write 7 above the 8 in the Ones place.
- Step 6 (Multiply): $4 \times 7 = 28$. Write 28 underneath 28.
- Step 7 (Subtract): $28 - 28$ is 0. There is nothing more to divide and there is no remainder.
- Read the quotient on top of the line. 68 divided by 4 is 17.

$$\begin{array}{r} 17 \\ 4\overline{)\,68} \\ -\underline{40} \\ 28 \end{array}$$

7. Allow students to copy the standard algorithm for $68 \div 4$ from the board. Ask students to think about what is similar between their Quick Draw and using the standard algorithm.
8. Invite students to share their thinking with the class.
   Highlight any responses that mention starting to divide in the place with highest value and regrouping from Tens to Ones. Students should also observe that there are four groups and each group contains 17.
9. Repeat the steps to model how to solve $457 \div 3$. (152 R1)
10. Ask students where they see the remainder in this problem. Show students where to write the remainder next to the answer. Ask students to share what they noticed about this problem and any questions they have.
11. Allow students to copy the standard algorithm for $457 \div 3$ from the board.

$$\begin{array}{r} 152\ \text{R1} \\ 3\overline{)\,457} \\ -\underline{300} \\ 157 \\ -\underline{150} \\ 7 \\ -\underline{6} \\ 1 \end{array}$$

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Let's Try It (20 min)

1. Ask students to turn to Lesson 14 BUILD Let's Try It.
2. Write 454 ÷ 3 on the board. Ask students to solve this problem along with you in their Student Edition.
    - Step 1 (Set Up): Set up the problem. Identify where the dividend and divisor are in the problem.
    - Step 2 (Divide): Think: 4 ÷ 3 = 1 with a remainder. Write 1 above the line over the 4. Remind students that this 1 actually represents 100 since it is in the Hundreds place.
    - Step 3 (Multiply): Think: 3 × 100 = 300. Write 300 underneath 454. Point out that 300 is the part of the dividend that has just been divided.
    - Step 4 (Subtract): 454 – 300 = 154.
    - Step 5 (Divide): Look at 154. Point out that 150 is close to 154 and that a related fact is 15 ÷ 3 = 5. 150 ÷ 5 = 50. Write 5 above the line over the 5. Remind students that this 5 represents 50 since it is in the Tens place.
    - Step 6 (Multiply): Think: 3 × 50 = 150. Write 150 underneath 154.
    - Step 7 (Subtract): 154 – 150 = 4.
    - Step 8 (Divide): Think: 4 ÷ 3 = 1 with a remainder. Write a 1 above the line over the 4. This 1 represents 1 since it is in the Ones place.
    - Step 9 (Multiply): Think 3 × 1 = 3. Write 3 under 4.
    - Step 10 (Subtract): 4 – 3 = 1.
    - Step 11 (Divide): Since 1 cannot be divided evenly by 3, 1 is the remainder.

```
     151 R1
   ┌────
 3 │ 454
   −300
    ───
    154
   −150
    ───
      4
   −  3
    ───
      1
```

3. Ask students to work with a partner or small group to solve as many of the remaining problems as they can using the standard algorithm. If students are struggling, do another example on the board together.

Answer Key for Let's Try It:

1. 454 ÷ 3 = 151 R1
2. 778 ÷ 2 = 389
3. 368 ÷ 3 = 122 R2
4. 4,858 ÷ 4 = 1,214 R2

CONNECT (7 min)

Making Connections

1. Ask students to turn to Lesson 14 CONNECT Making Connections. Ask students to solve the problem using at least two different strategies.

Answer Key for Making Connections:

Accept all strategies that yield a correct answer.

$784 \div 7 = 112$

TEACHER NOTE: Consider using this activity as a formative assessment to determine which students may need additional instruction and practice.

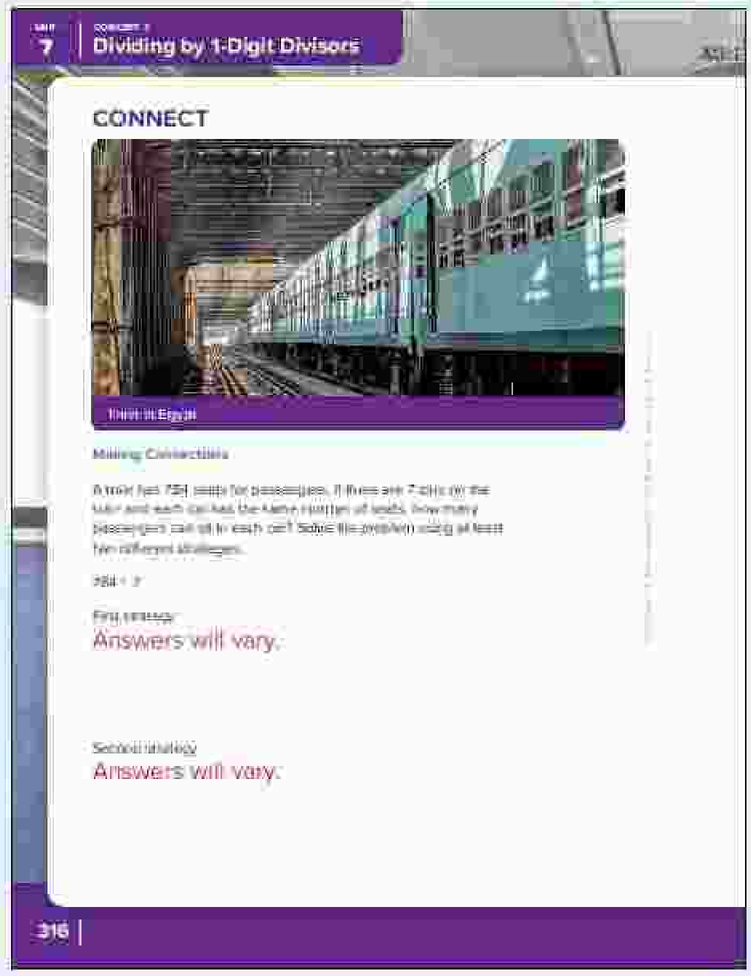
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to reflect on the different division strategies they have learned for dividing by one-digit numbers. Ask students which strategy is easiest for them to use. Ask students which strategy they want to practice more in order to improve their division skills.

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UNIT 7 | CONCEPT 2
Dividing by 1-Digit Divisors

CONNECT

Train in Egypt

Making Connections

A train has 784 seats for passengers. If there are 7 cars on the train and each car has the same number of seats, how many passengers can sit in each car? Solve the problem using at least two different strategies.

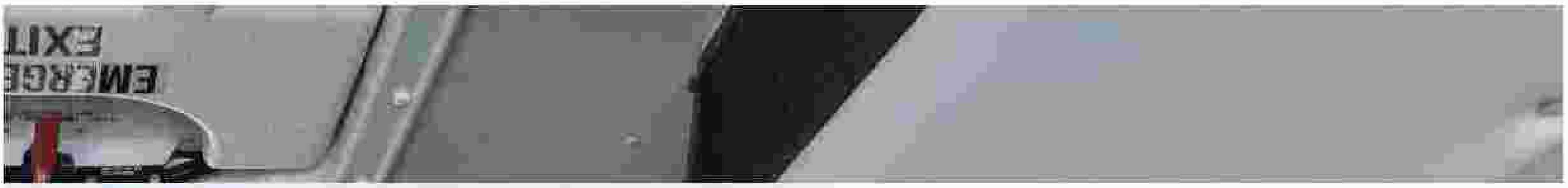
784 ÷ 7

First strategy:
Answers will vary.

Second strategy:
Answers will vary.

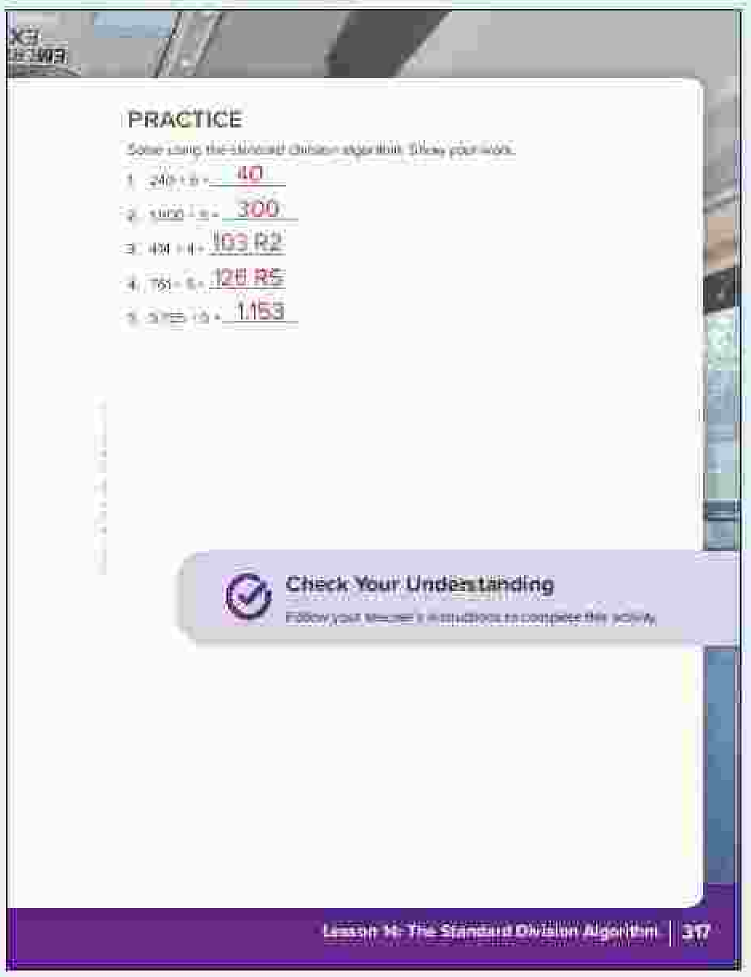
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PRACTICE

Solve using the standard division algorithm. Show your work.

1. 240 ÷ 6 = 40
2. [illegible] ÷ [illegible] = 300
3. 414 ÷ 4 = 103 R2
4. 761 ÷ 6 = 126 R5
5. 5,765 ÷ 5 = 1,153

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 14: The Standard Division Algorithm | 317

PRACTICE

Direct students to Lesson 14 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the standard algorithm.

4,200 ÷ 6 = 700

832 ÷ 4 = 208

2,895 ÷ 2 = 1,447 R1

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LESSON 15
Division and Multiplication

Lesson Overview

In this lesson, students continue to practice the standard algorithm for division and determine where to place the first digit in the quotient. Students also learn how to use multiplication to check the accuracy of their quotients, with and without remainders. This lesson gives students continued opportunities to build fluency and to clear up misconceptions as they develop deep understanding of the process and meaning of division.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?

Learning Objectives

In this lesson

- Students will use properties of place value to accurately record quotients.
- Students will use the relationship between multiplication and division to check the accuracy of quotients.

Grade-Level Standards

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

accuracy, reasonable, regroup

Materials List

No additional materials are needed.

Preparation

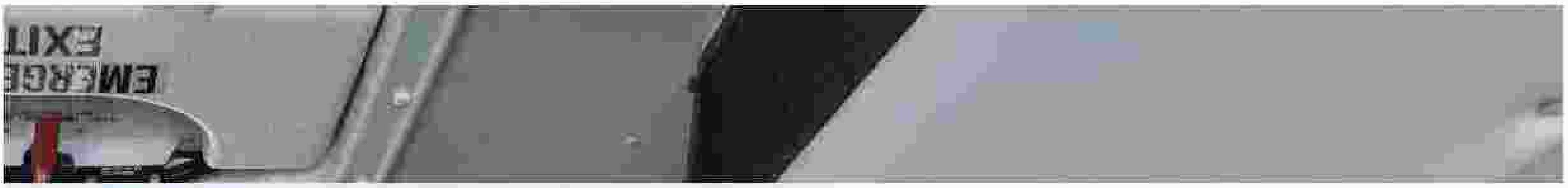
No additional preparation is needed.

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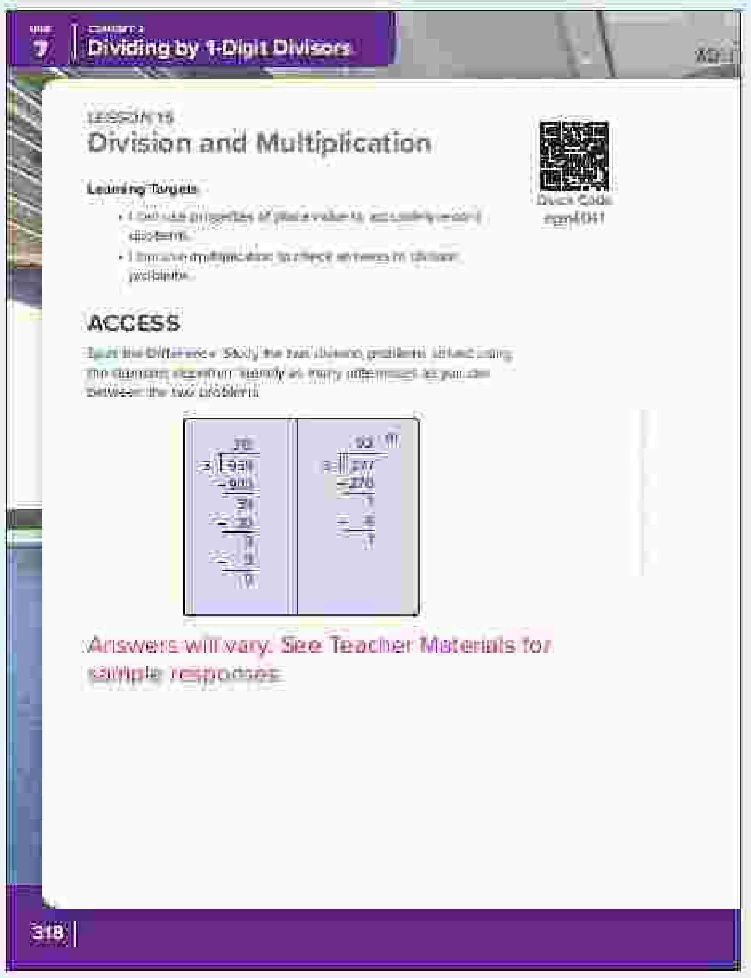
Lesson 15
Division and Multiplication

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UNIT 7 | Dividing by 1-Digit Divisors

LESSON 15

Division and Multiplication

Learning Targets

- I can use properties of place value to accurately record quotients.
- I can use multiplication to check answers to division problems.

Quick Code
egm4041

ACCESS

Spot the Difference: Study the two division problems solved using the standard algorithm. Identify as many differences as you can between the two problems.

Answers will vary. See Teacher Materials for sample responses.

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ACCESS (5 min)

COMMON MISCONCEPTIONS AND ERRORS

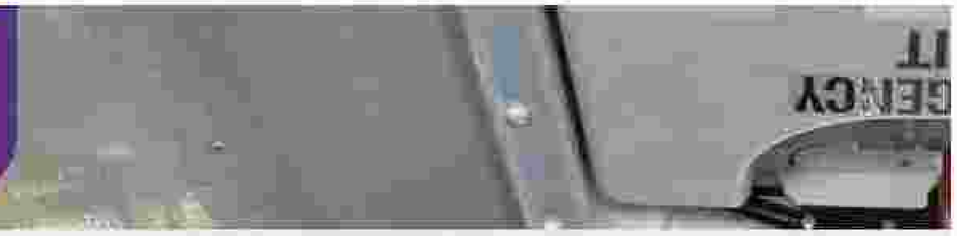
- Students may attempt to start dividing in the Ones place. However, they must start dividing in the place with the highest value when using the standard algorithm for division.
- Students may always put the first digit of the quotient above the first digit in the dividend without considering the place or the value of the digit.

Spot the Difference

1. Direct students to Lesson 15 ACCESS Spot the Difference and ask them study the two division problems solved using the standard algorithm. Ask students to identify as many differences as they can between the two problems.
2. Ask students to share their observations with their Shoulder Partner. Ask a few students to share their ideas with the class.

Answer Key for Spot the Difference:
Accept all correct responses and listen for correct use of mathematical language. Highlight responses that mention that, while both problems have three-digit dividends, one problem has a three-digit quotient but the other has a two-digit quotient.

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BUILD (45 min)

Place Value and the Quotient (30 min)

1. Explain to students that sometimes the quotient to a division problem has the same number of digits as the dividend, but sometimes it has fewer digits. Today students investigate why while practicing the standard algorithm.

2. Write 276 ÷ 3 on the board. Ask students to estimate the quotient.
   The quotient will be between 90 and 100. 3 × 90 = 270 and 3 × 100 = 300

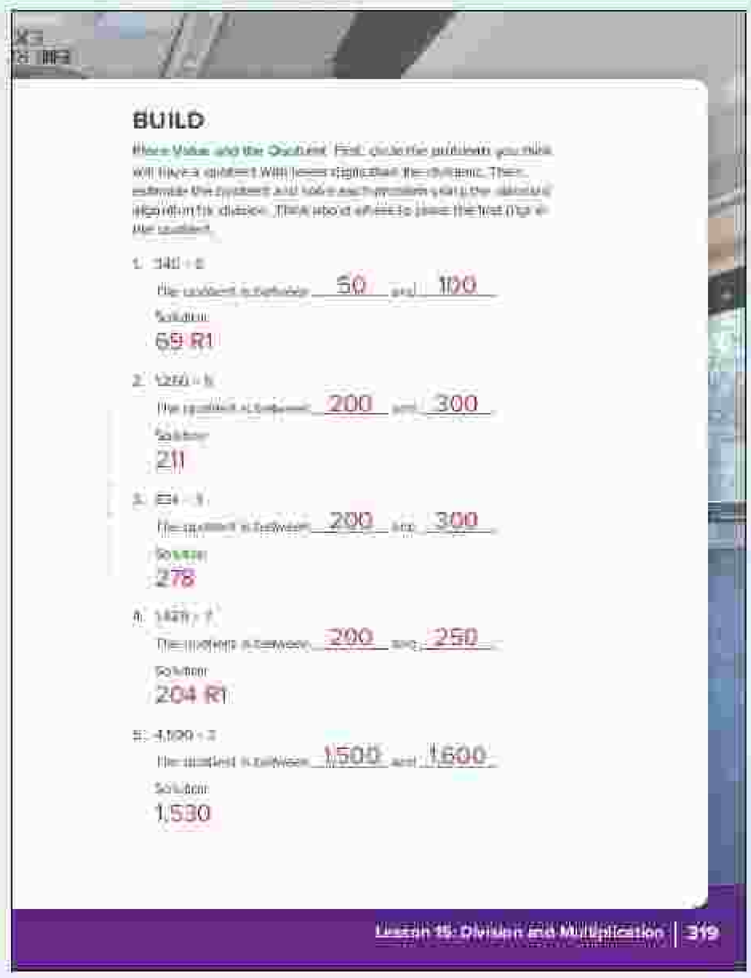
3. Ask students to help solve the problem using the Set Up-Divide-Multiply-Subtract steps.

   - Step 1 (Set Up): Set up the problem vertically.
   - Step 2 (Divide): Remind students to start dividing with the place that has the highest value. Think: 2 ÷ 3. The 2 represents 2 Hundreds, but can I divide 2 into 3 equal groups?
     - Point out to students that since there are not enough Hundreds to divide evenly among the 3 groups, the 2 Hundreds must be regrouped. The 2 Hundreds become 20 Tens.
     - However, there are already 7 Tens in the dividend. Point out to students that when they look at both the Hundreds digit and Tens digit together, they represent 27 Tens.
     - Think: 27 ÷ 3 = 9. Because we are dividing into 27 Tens (and not 2 Hundreds), we must write the 9 above the Tens place.
   - Step 3 (Multiply): Think: 3 × 9 Tens, or 3 × 90, is 270. Write 270 underneath 276.
   - Step 4 (Subtract): 276 − 270 = 6.
   - Step 5 (Divide): Think: 6 ÷ 3 = 2. Write 2 above the 6 in the Ones place.
   - Step 6 (Multiply): Think: 3 times 2 Ones is 6. Write 6 beneath the 6.
   - Step 7 (Subtract): Subtract 6 − 6 = 0. There is nothing left to divide and there is no remainder.

```
     92
3 ⟌ 276
  − 270
      6
  −   6
      0
```

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BUILD

Place Value and the Quotient First, circle the problems you think will have a quotient with fewer digits than the dividend. Then, estimate the quotient and solve each problem using the standard algorithm for division. Think about where to place the first digit in the quotient.

1. 346 ÷ 5
   The quotient is between 50 and 100.
   Solution:
   69 R1

2. 1266 ÷ 6
   The quotient is between 200 and 300.
   Solution:
   211

3. 834 ÷ 3
   The quotient is between 200 and 300.
   Solution:
   278

4. 1429 ÷ 7
   The quotient is between 200 and 250.
   Solution:
   204 R1

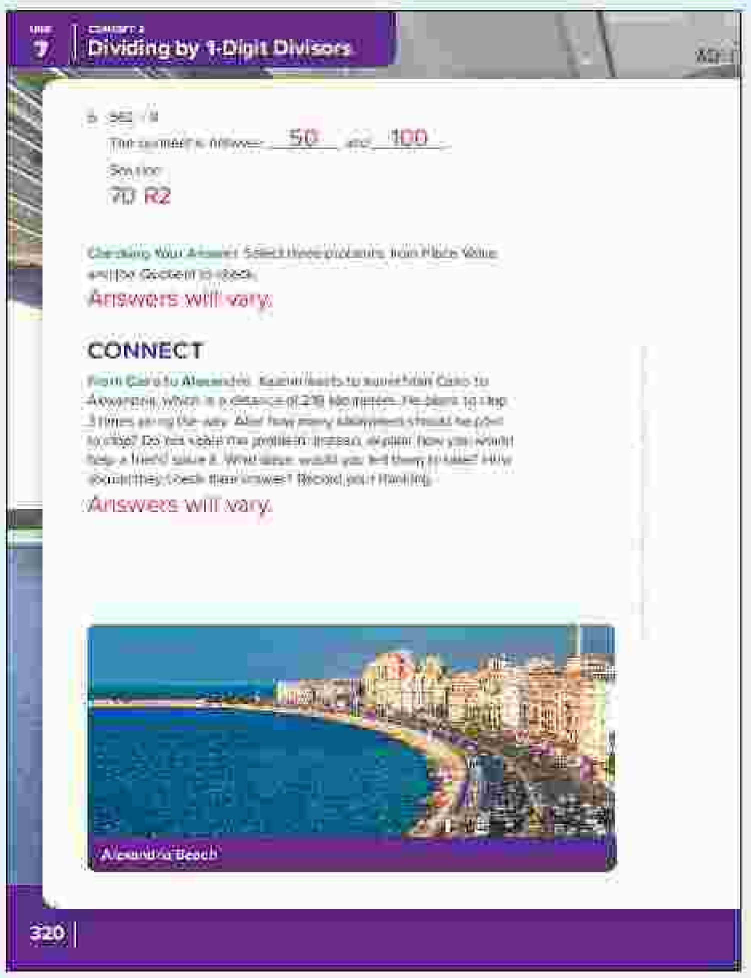
5. 4,590 ÷ 3
   The quotient is between 1,500 and 1,600.
   Solution:
   1,530

Lesson 15: Division and Multiplication | 319

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Unit 7 | Dividing by 1-Digit Divisors

6.
The quotient is between 50 and 100

70 R2

Answers will vary.

CONNECT

Answers will vary.

Alexandria Beach

320

4. Direct students to Lesson 15 BUILD Place Value and the Quotient. Read the directions with students to ensure they understand the task. Students may work independently or with a partner based on their needs.

5. Have students stop working at the end of this learning segment. Tell students they will now check their answers on their own.

Answer Key for Place Value and the Quotient:

1. $346 \div 5 = 69$ R1
2. $1{,}266 \div 6 = 211$
3. $834 \div 3 = 278$
4. $1{,}429 \div 7 = 204$ R1
5. $4{,}590 \div 3 = 1{,}530$
6. $562 \div 8 = 70$ R2

Checking Your Answer (15 min)

1. Ask students to discuss with their Shoulder Partner the different ways they have used multiplication in solving division problems. After a few minutes, remind students that multiplication and division are inverse operations. They can be used to "undo" each other and check answers.

2. Write $627 \div 5 =$ _______ on the board. Ask students to help you solve the problem using the standard algorithm (125 R2). If necessary, ask questions to prompt students' thinking about each step of the process, where to record the quotient, and how to record the products and differences.

3. Explain to students that estimation can help us decide whether an answer is reasonable, but multiplication can be used to check if an answer is correct. Model how to use multiplication to check the quotient of $627 \div 5$ by multiplying $125 \times 5 =$ _______ on the board. Ask students to help you solve the multiplication problem. (625)

4. Since the product and the dividend are not the same, ask students if the quotient is incorrect. Ask a few students to share their ideas. Highlight any responses that mention the remainder.

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5. Explain to students that when checking division using multiplication, students must multiply the quotient by the divisor and then add the remainder. If the quotient and the remainder are correct, the answer should be the same as the dividend.
6. Direct students to Lesson 15 BUILD Checking Your Answer. Ask students to select three problems from Lesson 15 BUILD Place Value and the Quotient and check the answers to those problems using multiplication.

CONNECT (7 min)

From Cairo to Alexandria Ask students to turn to Lesson 15 CONNECT From Cairo to Alexandria and read the prompt silently. Make sure students understand that they are not being asked to find the quotient, but must describe the steps they would tell a friend to take to solve it.

Answer Key for From Cairo to Alexandria:

Students should describe steps to solve the division problem using the area model, the partial products algorithm, or the standard algorithm. Students may recommend that their friend repeatedly subtract 3 from 219. While this strategy will yield a correct answer, it is not efficient. Students should also recommend that their friend check their answer by multiplying the quotient and divisor.

TEACHER NOTE: Consider using this activity as a formative assessment to determine which division strategy students feel most comfortable using and to identify students who need additional instruction in practice in any or all division strategies.

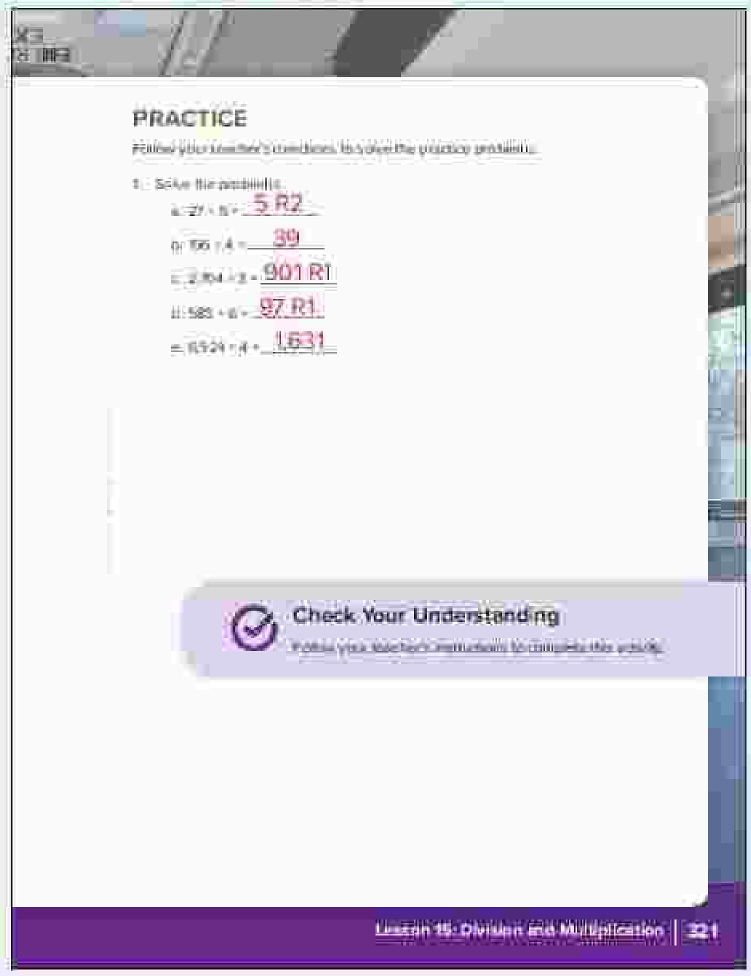
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss the challenges of teaching someone else how to solve division problems versus solving the problem themselves. Encourage students to ask questions of each other and to seek clarity through questioning.

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PRACTICE

Follow your teacher's directions to solve the practice problems.

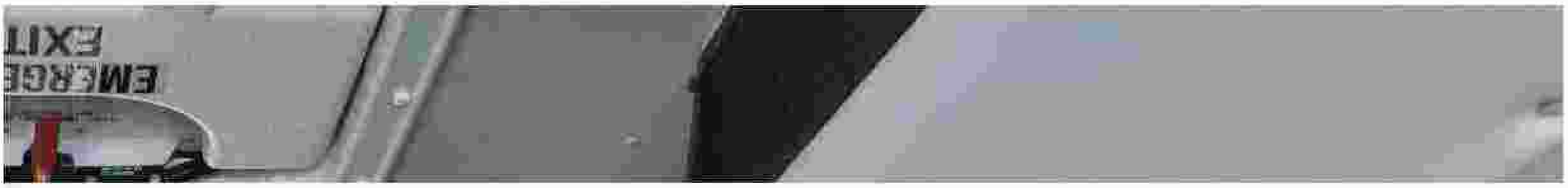
1. Solve the problems.
   a. 27 ÷ 5 = 5 R2
   b. 156 ÷ 4 = 39
   c. 2,704 ÷ 3 = 901 R1
   d. 583 ÷ 6 = 97 R1
   e. 6,524 ÷ 4 = 1,631

Check Your Understanding

Follow your teacher's instructions to complete this activity.

Lesson 15: Division and Multiplication | 321

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PRACTICE

Direct students to Lesson 15 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the standard algorithm. Use multiplication to check your answers.

1. 48 ÷ 7 = 6 R 6
2. 840 ÷ 6 = 140
3. 3,017 ÷ 3 = 1,005 R 2
4. 6,548 ÷ 8 = 818 R 4
5. 760 ÷ 8 = 95

LESSON 16
Solving Challenging Story Problems

Lesson Overview

In this lesson, students practice all four operations—or a combination of operations—to solve problems. Students should be applying concepts from place value, multiplication, patterns in multiplication and division, and division strategies to solve and check division problems. This approach helps students understand that skills and concepts in mathematics are indeed interconnected and reveal patterns that can be used to build understanding and solve problems.

Lesson Essential Question

- How can we use math to help us understand and solve real-world problems?

Learning Objectives

In this lesson

- Students will organize information in story problems to determine when to add, subtract, multiply, or divide.
- Students will solve story problems using addition, subtraction, multiplication, and division.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

Vocabulary Check-In

Review vocabulary as needed.

Materials List

- Unit 7 Lesson 16 Show and Solve Story Problems

Preparation

Photocopy and cut apart the story problems in the Blackline Master at the end of the volume.

Place the story problems around the room.

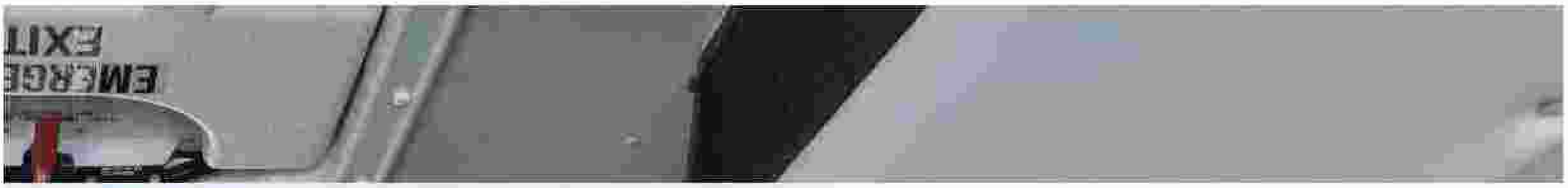
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Lesson 16
Solving Challenging Story Problems

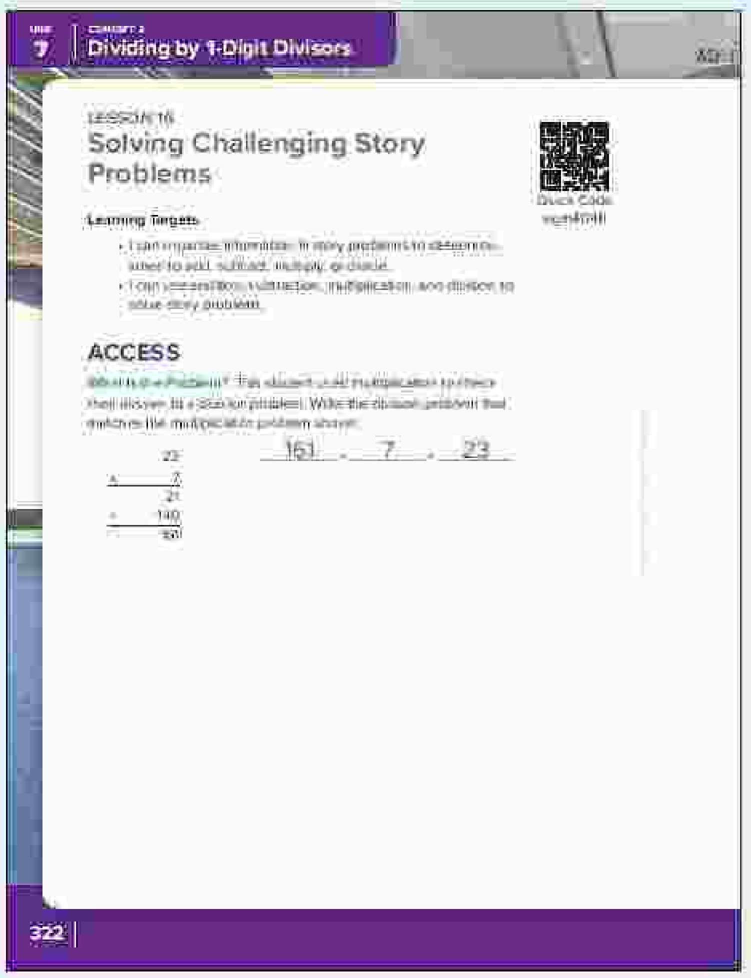
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UNIT 7 | CONCEPT 2
Dividing by 1-Digit Divisors

LESSON 16
Solving Challenging Story Problems

Quick Code

Learning Targets

- I can organize information in story problems to determine when to add, subtract, multiply, or divide.
- I can use addition, subtraction, multiplication, and division to solve story problems.

ACCESS

What Is the Problem? This student used multiplication to check their answer to a division problem. Write the division problem that matches the multiplication problem shown.

$$\begin{array}{r} 23 \\ \times \quad 7 \\ \hline 21 \\ +\ 140 \\ \hline 161 \end{array}$$

161 ÷ 7 = 23

322

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may solve part of a problem and think they are finished. It is important for students to thoroughly understand what is happening in a problem before solving it. This is part of any effective problem-solving process.
- Students who rely on key words may misinterpret what is happening in the problem. Using keywords in context is helpful in problem solving.

What Is the Problem?

1. Ask students to describe the process for using multiplication to check the answers to division problems. Encourage and praise the accurate use of mathematical language. Provide the language as needed, writing terms on the board so all students can see them.
2. Ask students to turn to Lesson 16 ACCESS What is the Problem? to solve the problem. After a few minutes, go over the answer together.

Answer Key for What Is the Problem?:
161 ÷ 7 = 23

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BUILD (40 min)

Three Reads (15 min)

1. Direct students to the first story problem in Lesson 16 BUILD Three Reads. Students should follow along while the problem is read aloud.
2. Ask students to record what is happening in the problem.
3. For the second read, choral read the problem with the entire class.
4. Ask the students to record the quantities they observe in the problem.
5. For the third read, ask students to read the problem with a partner.
6. Ask students to record mathematical questions they could ask about this situation.
7. Reveal to students the actual question for the story problem and ask them to write the question in the blank: How many rows will they need for all of their plants?
8. Ask students to work with a partner to show how they would organize the information in the problem and solve. Tell students there are multiple steps to solving this story problem.
9. Call on students to share out their ideas.

   TEACHER'S NOTE: If needed, use a Think Aloud to model for students how to organize the information for the problem. Be sure to emphasize the first and second steps.

10. Ask students to work with a partner to complete Problem 2 using the Three Reads strategy.

Answer Key for Three Reads:

1. Students should first add find the total number of plants (35 + 16 + 9 = 60) and then divide the total number of plants by 6 rows (60 ÷ 6 = 10 rows).
2. Students should multiply 14 × 6 to find how the mass of cans collected by Saleem (14 × 6 = 84 kg). Students should then divide 84 by 7 to find the number of bags Saleem needs for his cans. 84 ÷ 7 = 12 bags

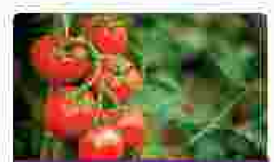
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BUILD

Three Reads: Read each problem three times. After each read, answer the question for that read in the chart that follows.

Problem 1



Tomatoes on the Vine

[illegible] and her mom want to plant a garden. They buy 35 tomato plants, 16 carrot plants, and 9 basil plants. They want to put the plants into rows of 6.

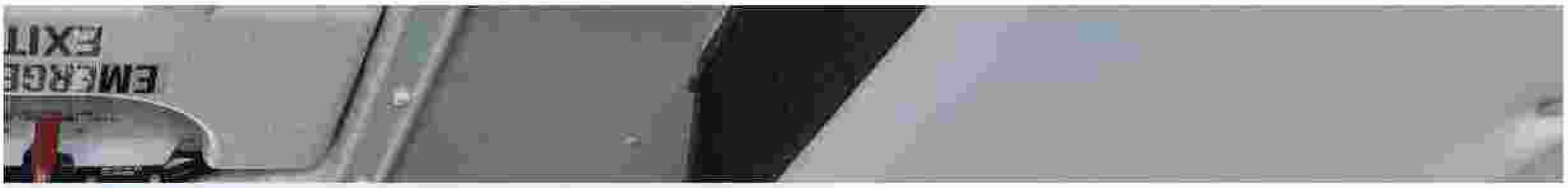
Read Number	Question	Answer
1	What is happening in the problem?	Answers will vary.
2	What quantities are in the problem?	Answers will vary.
3	What mathematical questions can you ask about this situation?	Answers will vary.

Fill in the question as your teacher reads it aloud.

How many rows will they need for all of their plants?

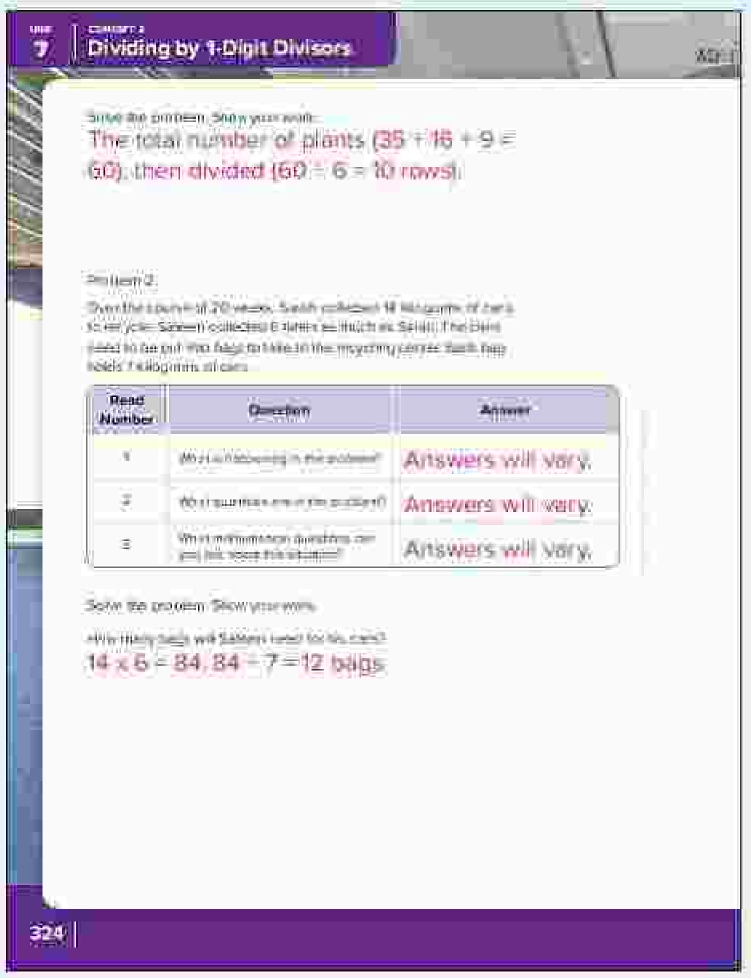
Lesson 16: Solving Challenging Story Problems | 323

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UNIT 7 | CONCEPT 2 Dividing by 1-Digit Divisors

Solve the problem. Show your work.

The total number of plants (35 + 16 + 9 = 60), then divided (60 ÷ 6 = 10 rows).

Problem 2

Read Number	Question	Answer
1		Answers will vary.
2		Answers will vary.
3		Answers will vary.

Solve the problem. Show your work.

14 × 6 = 84, 84 ÷ 7 = 12 bags

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Show and Solve (25 min)

1. Direct students to Lesson 16 BUILD Show and Solve and explain to students that they will move around the room solving story problems. Remind students that some of the problems may have multiple steps and may require addition, subtraction, multiplication, and/or division. Advise students that they may not have time to complete all of the problems, but should try to solve as many as they can.
2. Allow students to walk around the room, select problems, record the numbers of the problems they are solving, and solve the problems.

Answer Key for Show and Solve:
Strategies may vary. Accept all strategies that yield a correct answer.

1. (28 × 4) + (3 × 12) ÷ 4 =
   112 + 36 = 148
   148 ÷ 4 = 37 pencils
2. 1,500 − 135 = 1,365; 1,365 − 141 = 1,224 envelopes
3. 396 − 276 = 120 (shortest book)
   120 × 3 = 360 pages (middle book)
4. 153 − 19 = 134; 134 − 27 = 107 cones
5. 1,421 × 8 = 11,368 tourists
6. (7 × 9) + (5 × 10) = total crayons
   63 + 50 = 113 crayons
7. 682 + 117 = 799; 799 − 45 = 754; 754 + 130 = 884 gems
8. (2 × 14) + (2 × 22) = total cost
   28 + 44 = 72 LE for one family
   72 × 4 = 288 LE
9. 352 ÷ 8 = 44 toys
10. 1,164 + 20 = 184 = 23 rows

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CONNECT (7 min)

Comparing Answers

1. Direct students to Lesson 16 CONNECT Comparing Answers. Ask students to compare answers with a partner who solved one of the same problems. Encourage students to discuss the steps and strategies they used to solve the problem.
2. Allow students to repeat this a few times with different partners.

WRAP-UP (3 min)

Let's Chat About our Learning

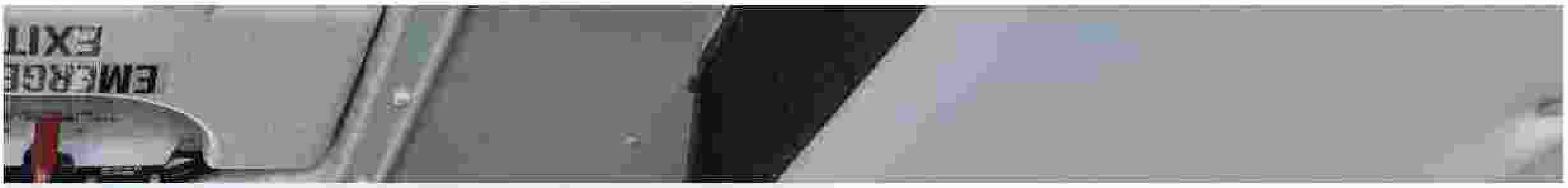
Ask students to share situations in their own lives when they might need to add, subtract, multiply, or divide. Possible answers include: earning money, spending money, sharing with siblings or friends, cooking, traveling, playing a game, planning a party, taking care of pets, sewing.

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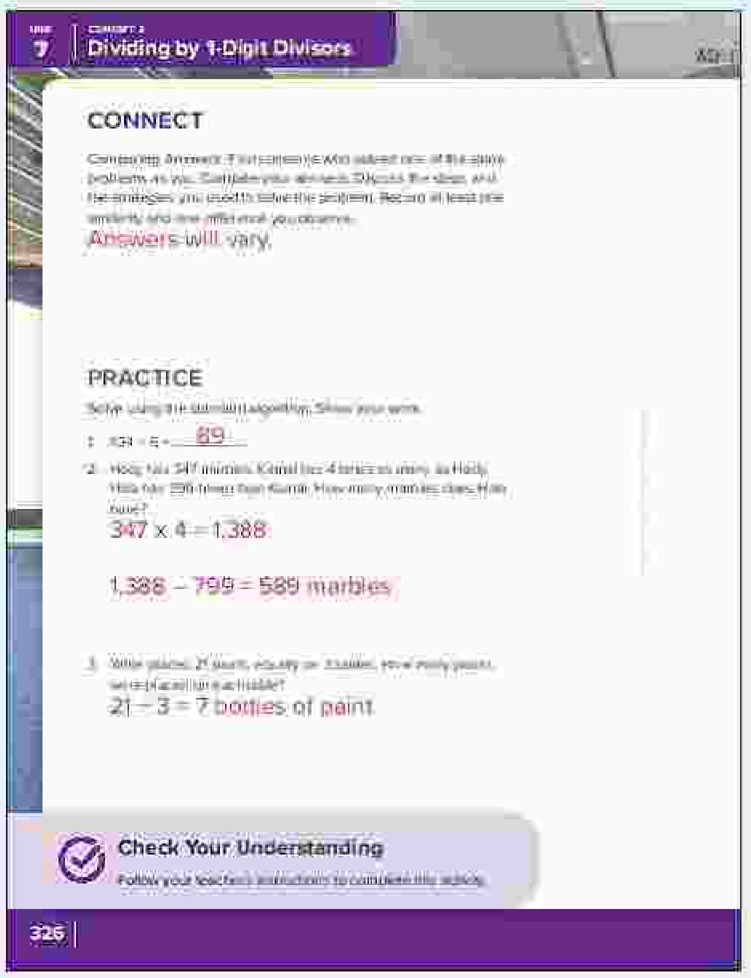
Problem Number	Solution
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.
	Answers will vary.

Lesson 16: Solving Challenging Story Problems | 325



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Unit 7 | Dividing by 1-Digit Divisors

CONNECT

Answers will vary.

PRACTICE

1. 89
2. 347 × 4 = 1,388

   1,388 − 799 = 589 marbles
3. 21 ÷ 3 = 7 bottles of paint

Check Your Understanding

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PRACTICE

Direct students to Lesson 16 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the standard algorithm.

1. 171 cans were packed equally into three boxes. How many cans were in two boxes?

   171 ÷ 3 = 57

   57 × 2 = 114 boxes

   In one month, Nour read 814 pages. In the same month, his sister read 3 times as many pages as Nour. How many pages did Nour and his sister read altogether?

   814 × 3 = 2,442

   2,442 + 814 = 3,256 pages
2. 156 ÷ 4 = 39

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 2 Dividing by 1-Digit Divisors. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed below, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- How can the relationship between multiplication and division be used to solve problems?
- How can we use our knowledge of place value to multiply and divide more efficiently?
- How can we use different strategies to help us understand multidigit multiplication and division?
- How can we use math to help us understand and solve real-world problems?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to dividing by one-digit divisors.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.A.2.d Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

4.A.2.e Illustrate and explain calculations using equations or models.

Materials List

Materials may vary

Preparation

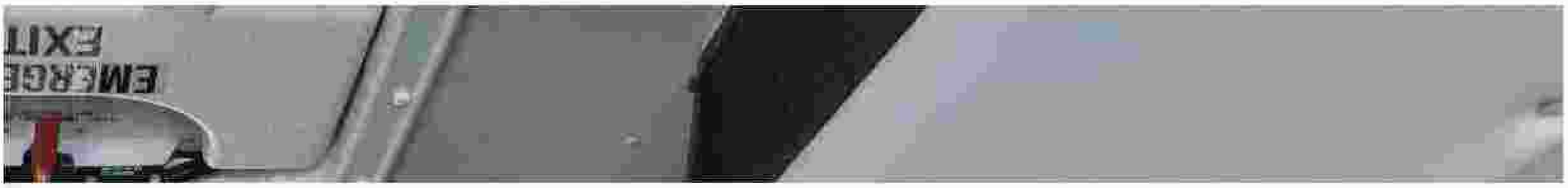
Preparation may vary

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Concept Check-In and Remediation

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4.C.1.d Solve multistep word problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

Review concept vocabulary as needed.

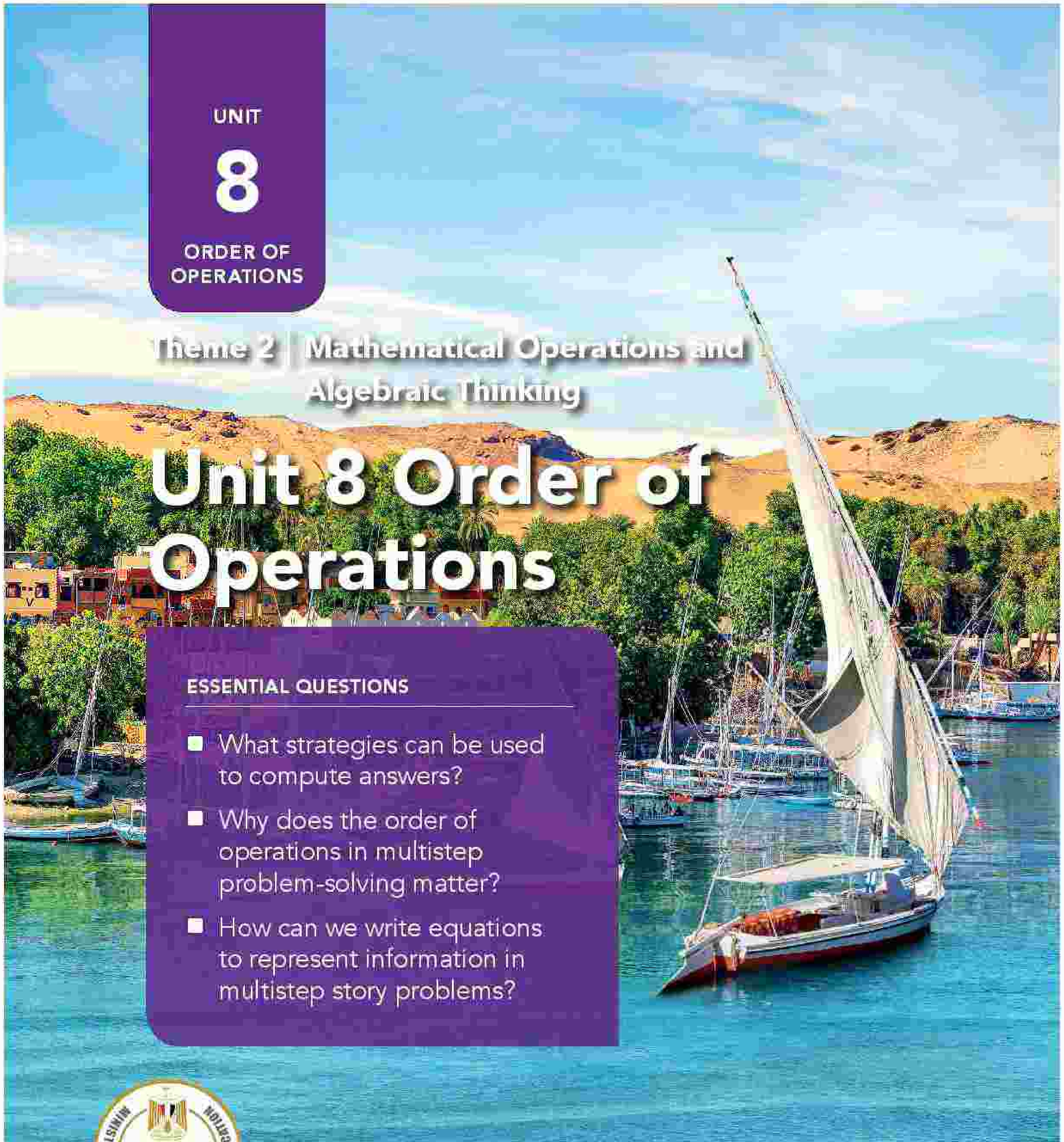
COMMON MISCONCEPTIONS AND ERRORS

- Students may be confused by having a reminder in a division problem. They may try to place the remainder into an existing group or into an additional group, both leading to unequal sharing.
- Students may have difficulty determining which multiples to use to start decomposing a dividend when using an area model.
- Students who are confused with what to do with the remainder may try to add it to or subtract it from the quotient.
- Students may be confused by how many zeros to put in a quotient, especially when the related fact includes a zero.
- Students may have difficulty determining which multiples to use to start decomposing a dividend.
- Students may attempt to start dividing in the Ones place. However, it is important to start dividing in the place with the highest value when using the standard algorithm for division.
- Students may always put the first digit of the quotient above the first digit in the dividend without considering the place or value of the digit.

Remediation: Correcting Misconceptions

If...	Then...
Students have trouble understanding what the remainder is or what it represents in a problem.	Review Lesson 10. Consider engaging students in a hands-on activity using physical objects like beans or buttons. In the activity, students practice dividing objects into groups and determining how many are left over.
If... Students have trouble decomposing dividends into multiples of the divisor in a division problem.	**Then...** Review Lessons 12 and 13. Consider having students practice reciting or writing multiples of the divisor. For larger numbers, consider having students practice reciting or writing multiples of 10 times or 100 times the divisor (40, 80, 120, 160 . . . or 400, 800, 1,200, 1,600 . . .)
If... Students have difficulty understanding how the dividend is changing when using the standard algorithm.	**Then...** Review Lessons 14 and 15. Consider engaging students in a hands-on activity using the Base Ten blocks. In the activity, students model dividing the dividend and regrouping from the place with the highest value to the place with lowest value.





UNIT

8

ORDER OF OPERATIONS

Theme 2 | Mathematical Operations and Algebraic Thinking

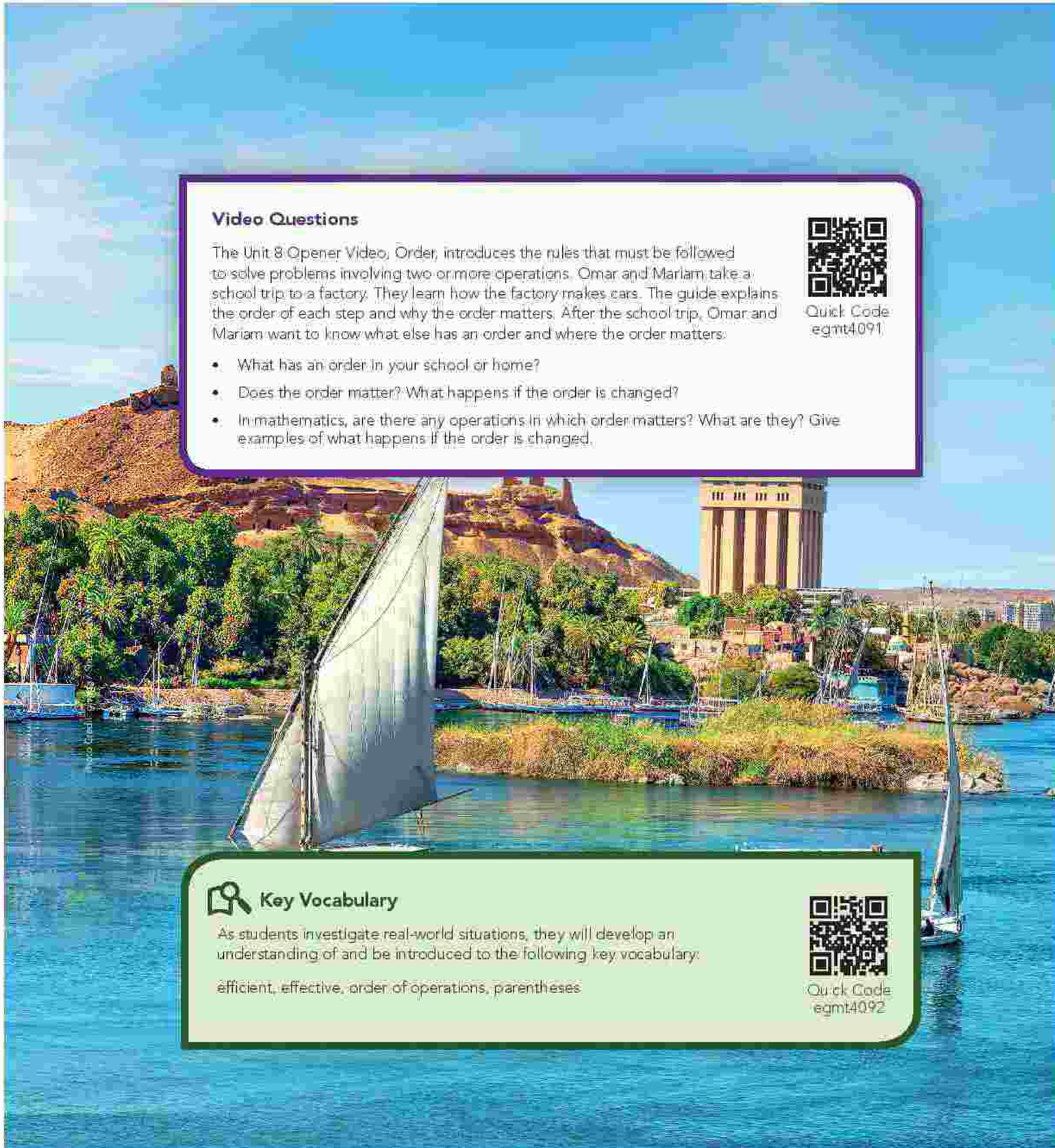
Unit 8 Order of Operations

ESSENTIAL QUESTIONS

- What strategies can be used to compute answers?
- Why does the order of operations in multistep problem-solving matter?
- How can we write equations to represent information in multistep story problems?

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

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Video Questions

The Unit 8 Opener Video, Order, introduces the rules that must be followed to solve problems involving two or more operations. Omar and Mariam take a school trip to a factory. They learn how the factory makes cars. The guide explains the order of each step and why the order matters. After the school trip, Omar and Mariam want to know what else has an order and where the order matters.

Quick Code
egmt4091

- What has an order in your school or home?
- Does the order matter? What happens if the order is changed?
- In mathematics, are there any operations in which order matters? What are they? Give examples of what happens if the order is changed.

Key Vocabulary

As students investigate real-world situations, they will develop an understanding of and be introduced to the following key vocabulary:

efficient, effective, order of operations, parentheses

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Unit Storyline

Unit 8 Order of Operations Storyline

The Order of Operations unit extends students' working knowledge of the order of operations. Students write equations to represent story problems and write story problems to represent given equations. Students apply these understandings to investigate how the order in which operations are performed can affect the outcome. To support learning, students observe video footage and solve real-world problems to enhance their understanding of order of operations.

Unit Standards

4.A.2	Use place value understanding and properties of operations to perform multidigit arithmetic.
4.C.1.d	Solve multistep story problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.
4.C.1.d.i	Use letters in equations to represent unknown quantities.
4.C.1.e	Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
4.C.1.f	Follow the standard order of operations to solve equations with multiple operations.

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Unit 8 Structure and Pacing

If Mathematics instruction is based on 60 minutes/5 days a week, deliver the lessons as written in the Teacher Edition.

Concept 1: Order of Operations

Essential Questions

- What strategies can be used to compute answers?
- Why does the order of operations in multistep problem-solving matter?
- How can we write equations to represent information in multistep story problems?

Lesson 1	**Problem-Solving Strategies** **Learning Objective** • Students will apply strategies to solve addition, subtraction, multiplication, and division problems. **Student Learning Target** • I can apply strategies to solve addition, subtraction, multiplication, and division problems.
Lesson 2	**Which Comes First?** **Learning Objective** • Students will use the order of operations to solve equations with two operations. **Student Learning Target** • I can use the order of operations to solve problems with two operations.
Lesson 3	**Order of Operations** **Learning Objective** • Students will use the order of operations to solve equations with multiple operations. **Student Learning Target** • I can use the order of operations to solve problems with multiple operations.

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Unit Structure and Pacing *cont'd*

Lesson 4	**The Order of Operations and Story Problems** **Learning Objectives** • Students will use the order of operations to solve equations with multiple operations. • Students will write and solve an equation to represent a multistep story problem. **Student Learning Targets** • I can use the order of operations to solve problems with multiple operations. • I can write and solve an equation to represent what is happening in a multistep story problem.
	Concept Check-In and Remediation **Learning Objective** • Students will work to correct misconceptions and errors related to solving problems using the order of operations. **Student Learning Target** • I can correct my misconceptions and errors related to solving problems using the order of operations.

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Alternate Pacing Guides

If Mathematics instruction is based on 45 minutes/5 days a week, do the following:

Reduce ACCESS by 3 minutes

Reduce BUILD by 8 minutes

Reduce CONNECT by 2 minutes

Reduce WRAP-UP by 2 minutes

Strategies for reducing time in each section:

- Discuss fewer examples
- Eliminate Shoulder Partner conversations
- Shorten class discussions
- Work with students to complete ACCESS problems

If Mathematics instruction is based on 45 minutes/4 days a week and 90 minutes 1 day a week, do the following:

Follow the 45-minute approach for the 45-minute days

Teach two 45-minute lessons on the 90-minute day

If Mathematics instruction is based on 90 minutes/5 days a week, do the following:

Increase ACCESS by 5 minutes

Increase BUILD by 20 minutes

Increase CONNECT by 3 minutes

Increase WRAP-UP by 2 minutes

Strategies for increasing time in each section:

- Discuss additional examples as needed
- Extend class discussions
- Allow time for hands-on work with manipulatives and models
- Provide additional practice problems for students who need additional practice
- Encourage students to share and model their problem-solving strategies

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Mathematical Background Knowledge

Order of Operations

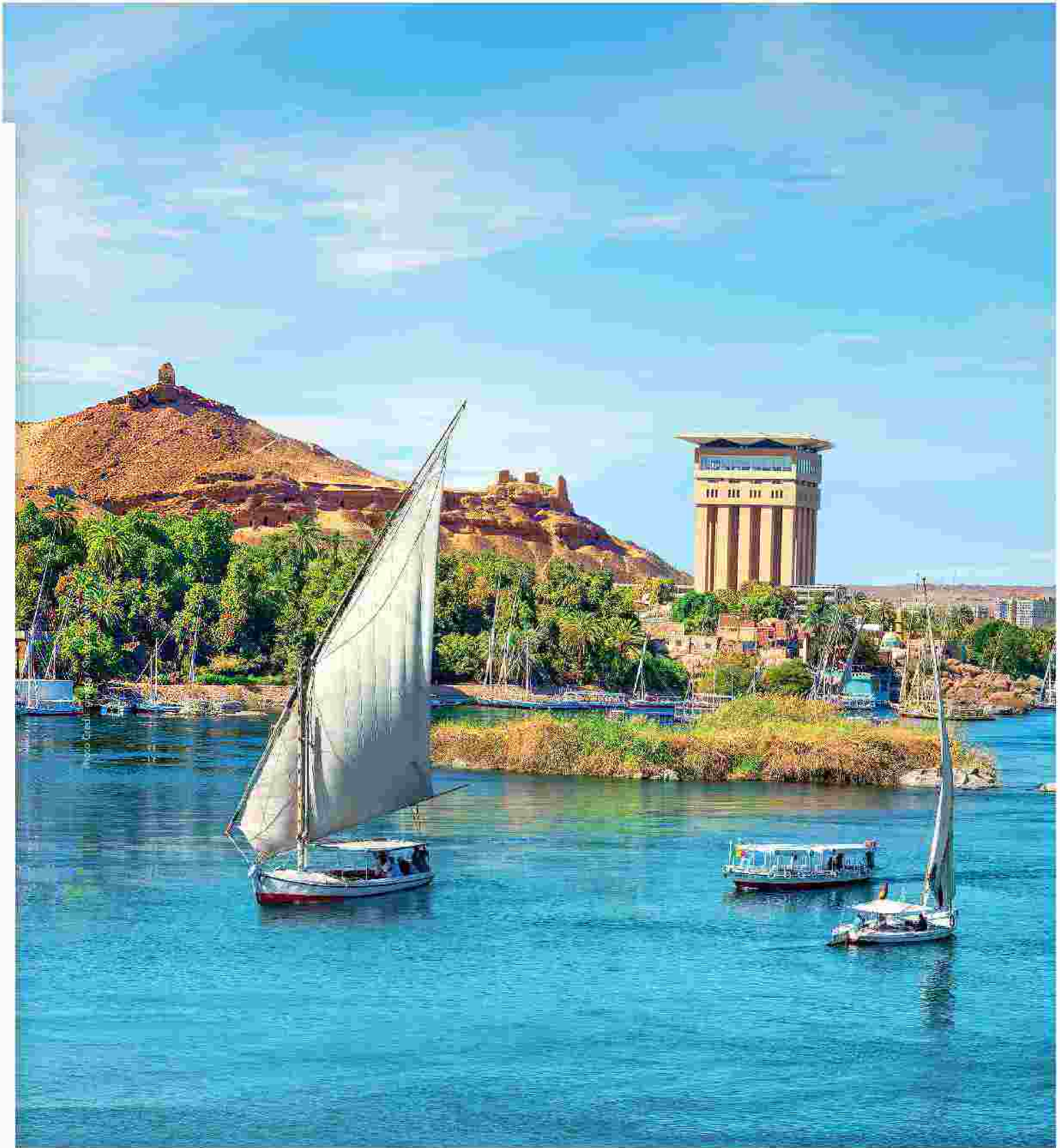
This unit asks students to apply many of the skills and concepts they have learned in the first half of the school year. Those skills include (but are not limited to) solving complex addition, subtraction, multiplication, and division problems; applying the Associative Property of Addition and Multiplication; developing strategies for solving story problems; using letters to represent unknowns in equations; and understanding the meaning of remainders in division problems. Students combine those skills and concepts to learn and apply a new concept—the standard order of operations.

In the standard order of operations, multiplication and division are performed first from left to right, and then addition and subtraction are performed from left to right. Students come to understand that the order in which operations are performed when solving a problem can affect the outcome. Therefore, the order of operations is essential in ensuring that there is only one correct answer to a problem.

Students are first introduced to the standard order of operations in the context of problems with only two operations. Students then solve problems involving multiple operations. Students should recall that multiplication and division must be performed before addition and subtraction, but the direction matters when problems have multiple operations. The order of operations states that multiplication and division are performed first from left to right, and then addition and subtraction is performed from left to right.

Students extend their understanding and application of the order of operations by writing equations to represent story problems and writing a story problem to represent a given equation. Students consider the context of each problem and develop an understanding of using parentheses to write equations. Parentheses are used to indicate what to do first when addition or subtraction needs to happen before multiplication or division. Students have seen parentheses in Unit 5 when they applied the Associative Property of Multiplication to solve problems. Students think about efficiency through discussing when parentheses are needed and when they are not. This work prepares students for work in Primary 5, where students continue to use the order of operations with whole numbers and decimals and utilize parentheses, braces, and brackets in numerical expressions.

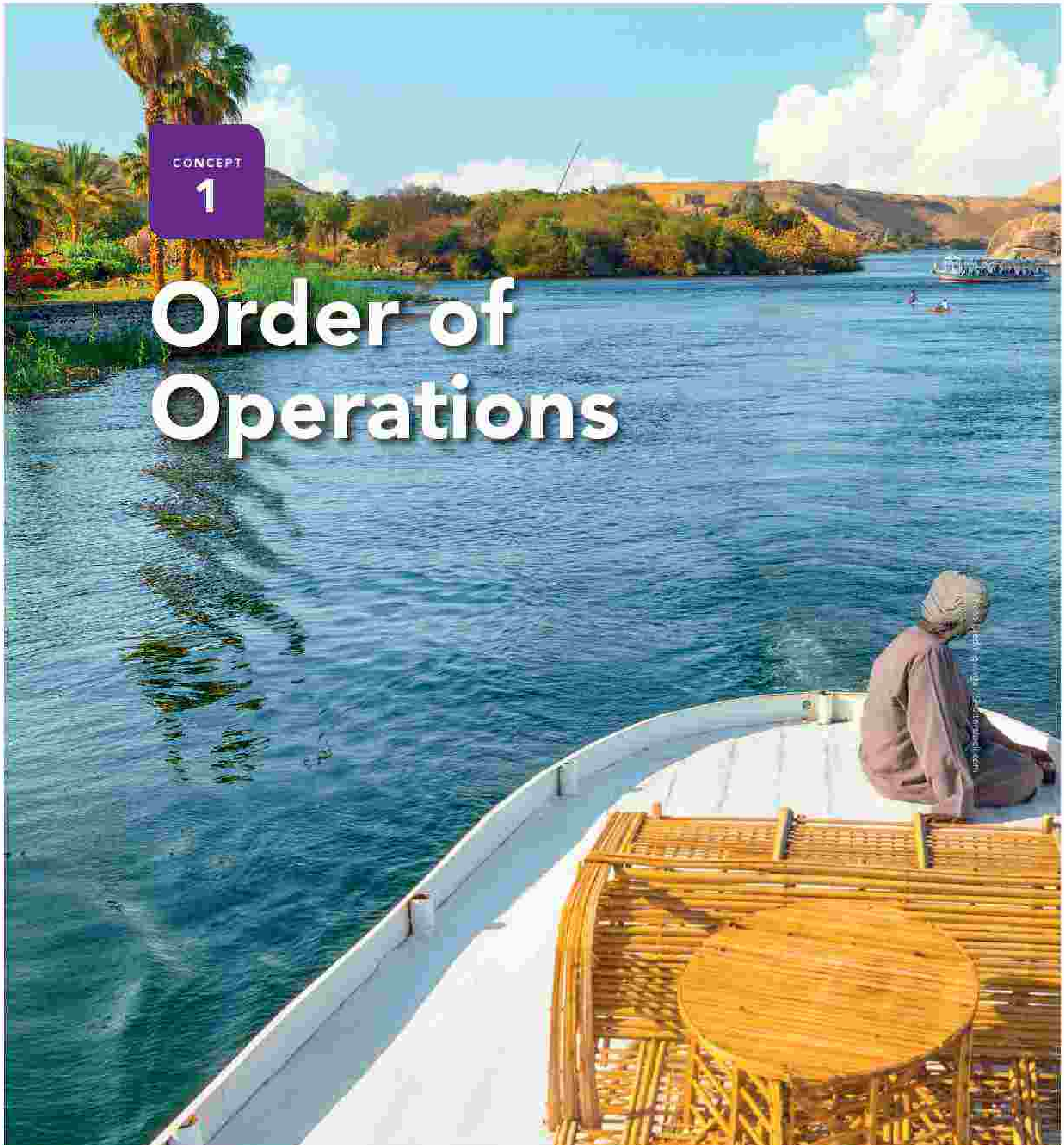
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CONCEPT 1

Order of Operations



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Concept Overview

In Concept 1: Order of Operations, students learn the standard order of operations and apply it to solve bare number problems and story problems. Students begin by reviewing problem-solving strategies and then solve problems involving two operations. They extend their understanding to solve problems with multiple operations and complex story problems. Students recall the use of parentheses and learn the role of parentheses in the order of operations. Students are given a variety of opportunities to practice solving problems with multiple operations, including writing their own story problems to match a given equation.

Concept Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.C.1.d Solve multistep story problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.i Use letters in equations to represent unknown quantities.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

4.C.1.f Follow the standard order of operations to solve equations with multiple operations.

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Concept Planner

Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
1 Problem-Solving Strategies	• Unit 8 Lesson 1 Information Gap Number Cards	Efficient Effective	• Students will apply strategies to solve addition, subtraction, multiplication, and division problems.	
2 Which Comes First?	• Order of Operations anchor chart	Order of operations	• Students will use the order of operations to solve equations with two operations.	
3 Order of Operations	• Order of Operations anchor chart	Order of operations	• Students will use the order of operations to solve equations with multiple operations.	
4 The Order of Operations and Story Problems	• Order of Operations anchor chart	Efficient Parentheses	• Students will use the order of operations to solve equations with multiple operations. • Students will write and solve an equation to represent a multistep story problem.	

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may have difficulty setting up problems and performing algorithms properly. While students should be working towards using the correct algorithms, they should use strategies they are comfortable with at this time.	Strategies We Know, Solve It, Writing About Math, Practice, Check Your Understanding
	• Students may always try to complete the calculations from left to right without looking carefully at the operations.	Number Talk, Exploring the Order of Operations, Writing About Math, Practice, Check Your Understanding
	• Students may always try to complete the calculations from left to right without looking carefully at the operations. • Students may have difficulty understanding the order of the steps when working through an equation with multiple operations.	Working Left to Right, Find the Answer, Who Is Correct?, Practice, Check Your Understanding
	• Students may follow the order of operations without considering the context of the problem. • Students may unnecessarily use parentheses to indicate what to do first in an equation. For example, they might write $25 \times 5 - 19$ as $(25 \times 5) - 19$. While this is not incorrect, this is not the most efficient way to write the equation.	Number Talk, The Order of Operations and Story Problems, Writing My Own Problem, Practice, Check Your Understanding

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Lesson Name	Materials for Lesson	Vocabulary Terms	Learning Objectives	
Concept Check-In and Remediation	• Materials may vary	Review concept vocabulary as needed.	• Students will work to correct misconceptions and errors related to solving problems using the order of operations.	

Opportunities for Assessment:

In addition to the assessment opportunities included in this chart, each concept will include a Concept Check-In.

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	Common Misconceptions and Errors	Opportunities for Formative Assessment
	• Students may always try to complete the calculations from left to right without looking carefully at the operations. • Students may have difficulty understanding the order of the steps when working through an equation with multiple operations. • Students may follow the order of operations without considering the context of the problem. • Students may unnecessarily use parentheses to indicate what to do first in an equation. For example, they might write $25 \times 5 - 19$ as $(25 \times 5) - 19$. While this is not incorrect, this is not the most efficient way to write the equation.	

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LESSON 1
Problem-Solving Strategies

Lesson Overview

In this lesson, students revisit and practice strategies for addition, subtraction, multiplication, and division and build fluency in solving problems efficiently. This step is essential in preparing students to solve multistep problems in which the order of operations matters.

Lesson Essential Question

- What strategies can be used to compute answers?

Learning Objective

In this lesson

- Students will apply strategies to solve addition, subtraction, multiplication, and division problems.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Vocabulary Check-In

effective, efficient

Materials List

- Unit 8 Lesson 1 Information Gap Number Cards (1 card per student)

Preparation

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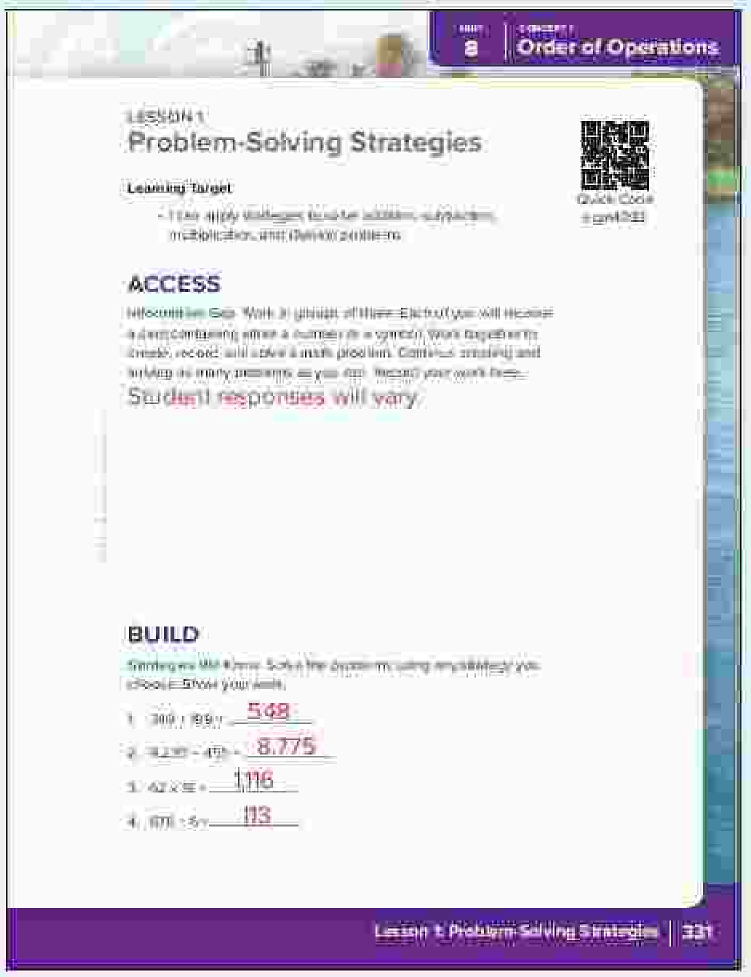


Lesson 1
Problem-Solving Strategies

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8 | Order of Operations

LESSON 1

Problem-Solving Strategies

Learning Target

ACCESS

Student responses will vary.

BUILD

1. 548
2. 8,775
3. 1,116
4. 113

Lesson 1: Problem-Solving Strategies | 331

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may have difficulty setting up problems and performing algorithms properly. While students should be working towards using the correct algorithms, they should use strategies they are comfortable with at this time.

Information Gap

1. Tell students they will be working in small groups to solve problems. Explain that each student will get a card—either a number card or an operation card.
2. Divide students into groups of three (or let them select their own groups). Distribute Information Gap Number Cards to students (1 card per student). Ask students to work together to create a problem, record it, and solve it.
3. Once a small group has solved their problem, the students should form new groups. The new group should work together to create a new problem, record it, and solve it.
4. After about 5 minutes, instruct students to stop and return to their seats. Ask a few students to share the problems they made and their solutions.

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BUILD (40 min)

Strategies We Know (15 min)

1. Remind students that they have learned a number of ways to solve addition, subtraction, multiplication, and division problems.
2. Direct students to Lesson 1 BUILD Strategies We Know. Ask students to work independently to solve Problems 1–4 using any strategy they know.
3. Once students are finished, ask them to share their problem-solving strategies with their Shoulder Partner. If students disagree on an answer, they should circle the problem.
4. Ask a few students to share a problem-solving strategy for each problem on the board. Allow students to correct their work in their Student Edition.
5. Remind students that, as they learn problem-solving strategies, they should practice applying them and find the strategies that are most effective and efficient for them.

Answer Key for Strategies We Know:

1. 349 + 199 = 548
2. 9,230 − 455 = 8,775
3. 62 × 18 = 1,116
4. 678 ÷ 6 = 113

Solve It (25 min)

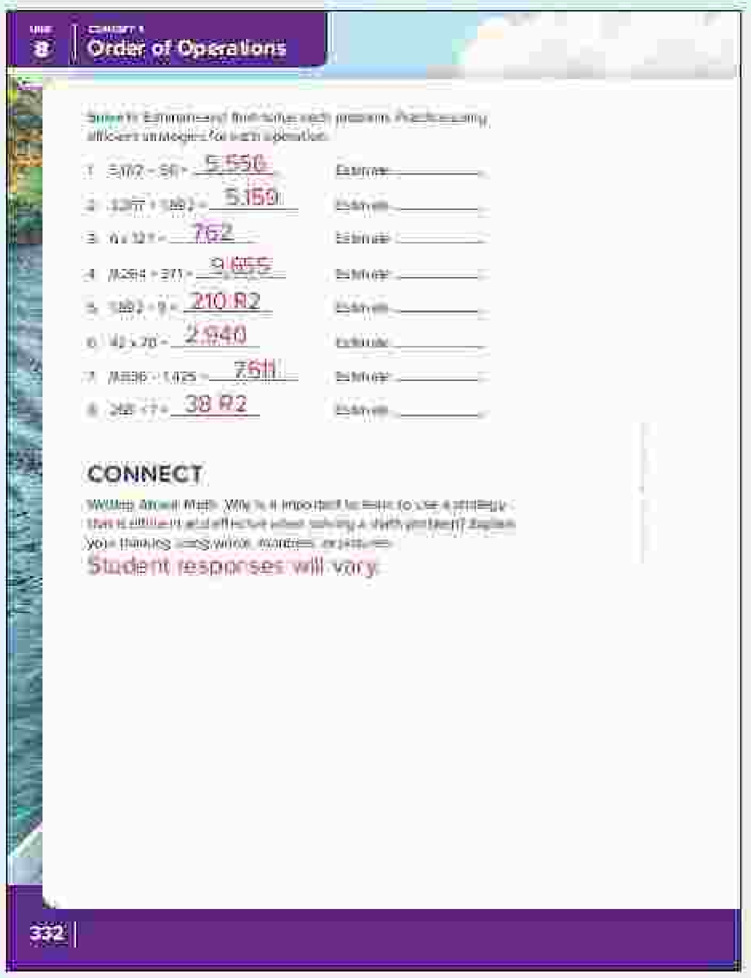
1. Ask students to turn to Lesson 1 BUILD Solve It and read the directions. Allow students to work with a partner or a small group to solve Problems 1–8. As students are working, walk around and observe the problem-solving strategies students are using. Are they choosing efficient and effective strategies? Who may need additional help? If many students are struggling, review useful strategies and algorithms on the board. If students have extra time, remind them that they can check their answers using opposite operations.

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8 Order of Operations

1. 5,556
2. 5,159
3. 762
4. 9,655
5. 210 R2
6. 2,940
7. 7,611
8. 38 R2

CONNECT

Student responses will vary.

332

2. With about 8 minutes remaining, go over the correct answers with students. Discuss why students may have had different estimates. If necessary, explain that estimates may differ depending on the estimation strategy used and the place to which each student rounded the original numbers. Allow students to correct their work in their Student Edition.

Answer Key for Solve It:

1. 5,612 − 56 = 5,556
2. 3,267 + 1,892 = 5,159
3. 6 × 127 = 762
4. 9,284 + 371 = 9,655
5. 1,892 ÷ 9 = 210 R2
6. 42 × 70 = 2,940
7. 9,036 − 1,425 = 7,611
8. 268 ÷ 7 = 38 R2

CONNECT (7 min)

Writing About Math

Direct students to Lesson 1 CONNECT Writing About Math and ask them to respond to the prompt. Students should recognize that efficient strategies take less time and that effective strategies will get the correct answer every time.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their responses to the Writing About Math prompt. If no students mention the importance of being able to work quickly and getting a correct answer every time, ask questions to prompt their thinking.

P4_Math_T2_U8_C1_TE.indd Page 617 28/06/21 9:10 AM f-0266wfh /130/DIS00002/work/indd/TE/Unit_8

PRACTICE

Direct students to Lesson 1 PRACTICE and have them complete the problems. Address student errors and misconceptions.

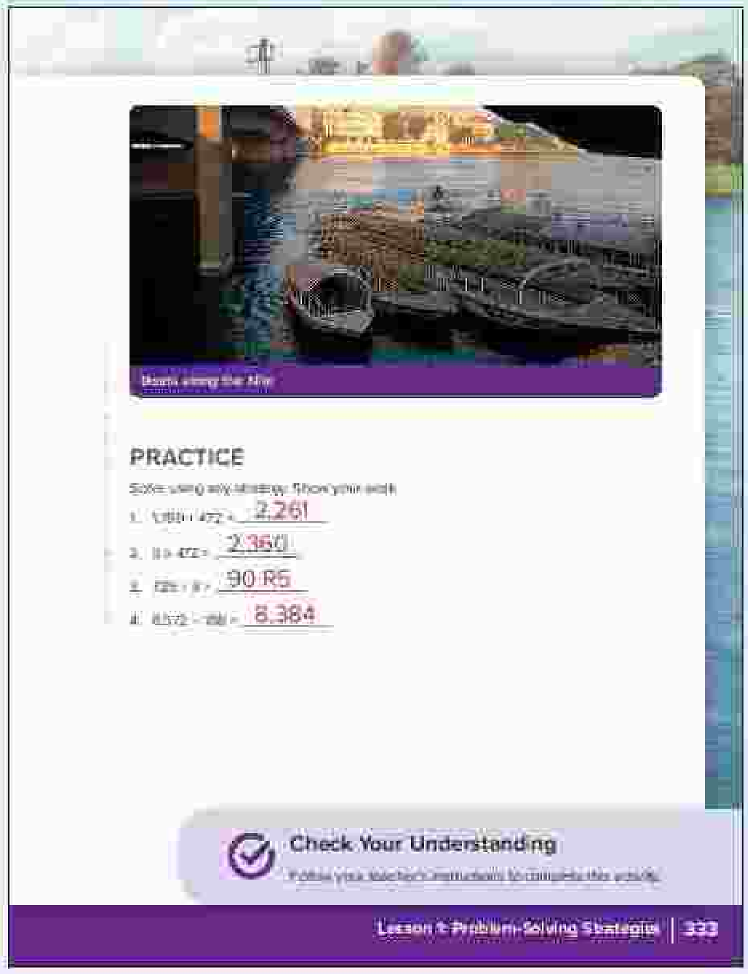
Check Your Understanding

Solve using any strategy. Show your work.

1. 18 × 52 = 936
2. 2,451 − 722 = 1,729
3. 561 ÷ 4 = 140 R1
4. 8,902 + 1,725 = 10,627

PRINT

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PRACTICE

1. 2,261
2. 2,360
3. 90 R5
4. 8,384

Check Your Understanding

Lesson 1: Problem-Solving Strategies | 333

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Materials List

- Order of Operations anchor chart

Order of Operations

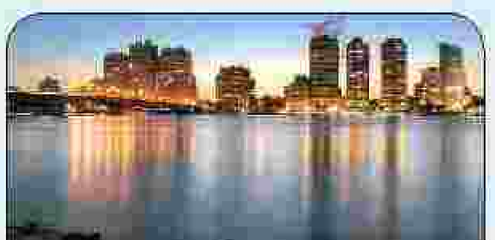
Parentheses
Multiplication and Division (left-to-right)
Addition and Subtraction (left-to-right)

Preparation

Make a large copy of the Order of Operations anchor chart to display.

Photo Credit: Mohammed Hamzah / Shutterstock.com

DIGITAL



Lesson 2
Which Comes First?

Quick Code
egmt4094

LESSON 2
Which Comes First?

Lesson Overview

In this lesson, students learn the standard order of operations and apply their new learning to solve problems involving two operations.

Lesson Essential Questions

- What strategies can be used to compute answers?
- Why does the order of operations in multistep problem-solving matter?

Learning Objective

In this lesson

- Students will use the order of operations to solve problems with two operations.

Grade-Level Standards

4.C.1.f Follow the standard order of operations to solve equations with multiple operations.

Vocabulary Check-In

order of operations

P4_Math_T2_U8_C1_TE.indd Page 619 28/06/21 9:11 AM f-0266with /130/DIS00002/work/indd/TE/Unit_8

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may always try to complete the calculations from left to right without looking carefully at the operations.

Number Talk

1. Direct students to Lesson 2 ACCESS Number Talk and ask students to work independently to solve the problems.
2. Once students have finished, ask them to work with a partner to draw a line connecting equations that are related to one another.
3. After a few minutes, ask students to choose at least one matched pair and write another equation that would be related to that pair.
4. Ask volunteers to share which connections they made and the equations they came up with on their own.

Answer Key for Number Talk:

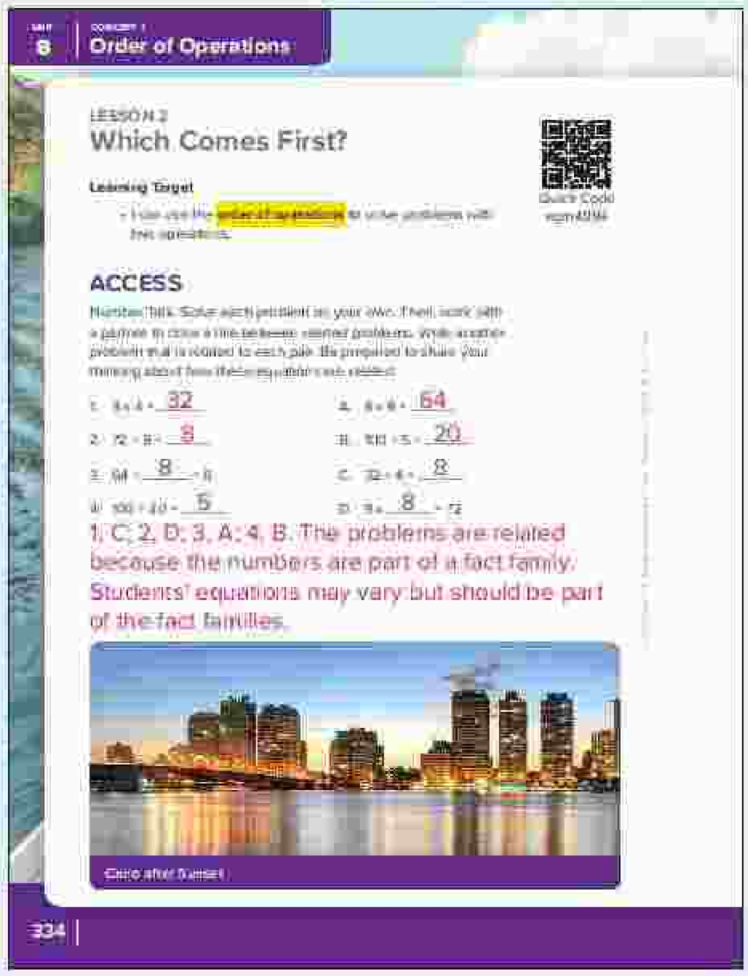
1. $8 \times 4 = 32$	A. $8 \times 8 = 64$
2. $72 \div 9 = 8$	B. $100 \div 5 = 20$
3. $64 \div 8 = 8$	C. $32 \div 4 = 8$
4. $100 \div 20 = 5$	D. $9 \times 8 = 72$

The problems are related because the numbers are part of a fact family. Students' equations may vary but should be part of the fact families.

TEACHER NOTE: Students learned about fact families relating multiplication and division in Primary 3. Make sure they are able to articulate why the facts are related and how they knew what number was missing. Students should recall the Commutative Property of Multiplication when writing their own related problem.

PRINT

Student Page 334


UNIT 8 | CONCEPT 1 Order of Operations

LESSON 2

Which Comes First?

Learning Target

ACCESS

1. 8 × 4 = 32 A. 8 × 8 = 64
2. 72 ÷ 9 = 8 B. 100 ÷ 5 = 20
3. 64 ÷ 8 = 8 C. 32 ÷ 4 = 8
4. 100 ÷ 20 = 5 D. 9 × 8 = 72

1, C; 2, D; 3, A; 4, B. The problems are related because the numbers are part of a fact family. Students' equations may vary but should be part of the fact families.

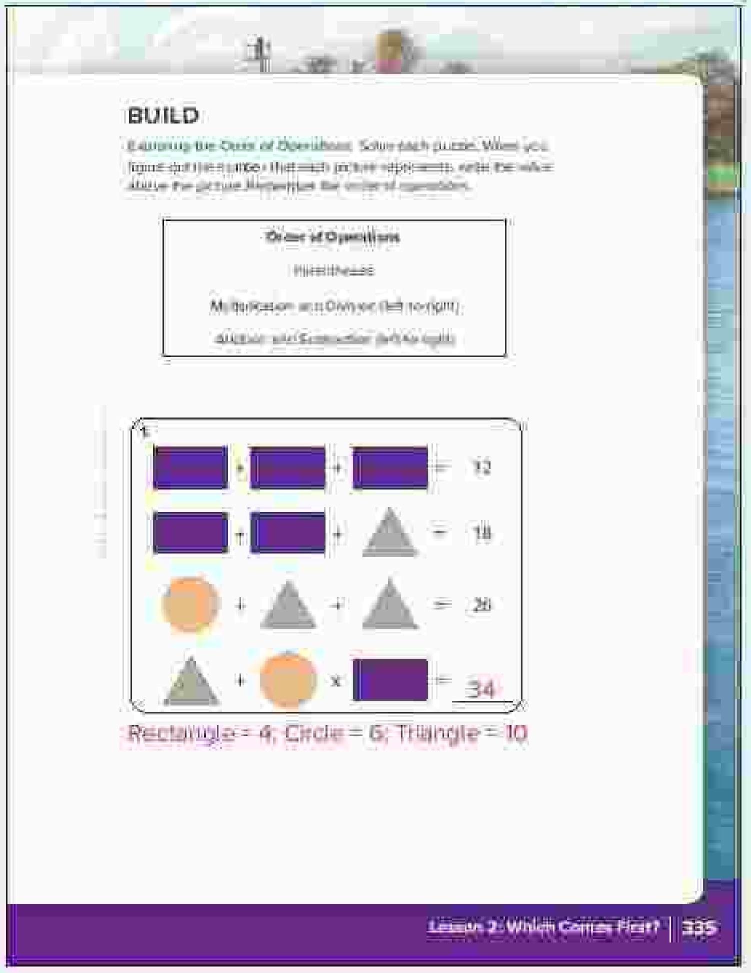
Cairo after Sunset

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PRINT

Student Page 335


BUILD

Order of Operations

Parentheses

Multiplication and Division (left to right)

Addition and Subtraction (left to right)

1.

= 12

= 18

= 26

= 34

Rectangle = 4; Circle = 6; Triangle = 10

Lesson 2: Which Comes First? | 335

BUILD (40 min)

Exploring the Order of Operations

1. Write 4 + 5 × 6 and 5 × 6 + 4 on the board and ask students to solve the two problems.

2. After a few minutes, ask students to compare their answers with a partner.

3. Ask volunteers to share their answers with the class. Students may say that 4 + 5 × 6 is 54 and that 5 × 6 + 4 is 34. Accept both answers at this time.

4. Point out that both problems have the same numbers and the same operations but seem to have different answers. Ask students to turn to their Shoulder Partner to discuss if they think it is possible that these two problems could have different answers.

   TEACHER NOTE: Students should recall that both addition and multiplication are commutative and that the order of the addends or the factors do not change the answer. However, that only applies when each operation is performed on its own. This problem contains both operations together.

5. Explain to students that when a problem has more than one operation, there are rules that help them make decisions about the order of operations.

6. Display the Order of Operations anchor chart. Explain to students that they will not be solving problems with parentheses or exponents at this time, so they can move down the order of operations to multiplication, division, addition, and subtraction. Tell students that the order of operations states that multiplication and division must be done before addition and subtraction.

7. Explain that because the order of operations states that the multiplication in the problem 4 + 5 × 6 must be done first even if it is not written first in the problem, both problems equal 34. Briefly model solving both problems on the board.

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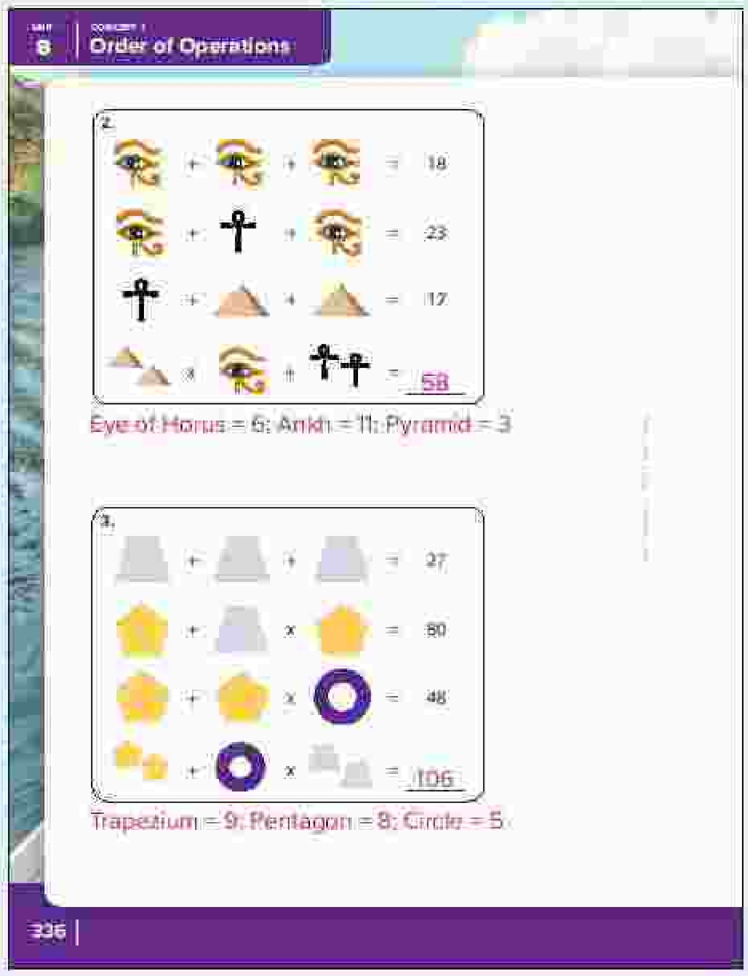
8. Direct students to Lesson 2 BUILD Exploring the Order of Operations. Point out that the Order of Operations anchor chart information is in their Student Edition. Students may refer to it at any time to help them solve problems. Explain to students that they will practice applying the order of operations by solving puzzles.

9. The pictures in the puzzle each represent numbers. Ask students to think about the pictures in the first row and discuss what they notice.
The 3 numbers equal 12 when added together.

10. Since each picture is the same, each picture must represent the same number. So, each rectangle in this problem represents 4. Ask students to write 4 above each rectangle.

PRINT

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UNIT 8 | CONCEPT 1
Order of Operations

2.
+ + = 18
+ + = 23
+ + = 17
× + = 58

Eye of Horus = 6; Ankh = 11; Pyramid = 3

3.
+ + = 27
+ × = 80
+ × = 48
+ × = 106

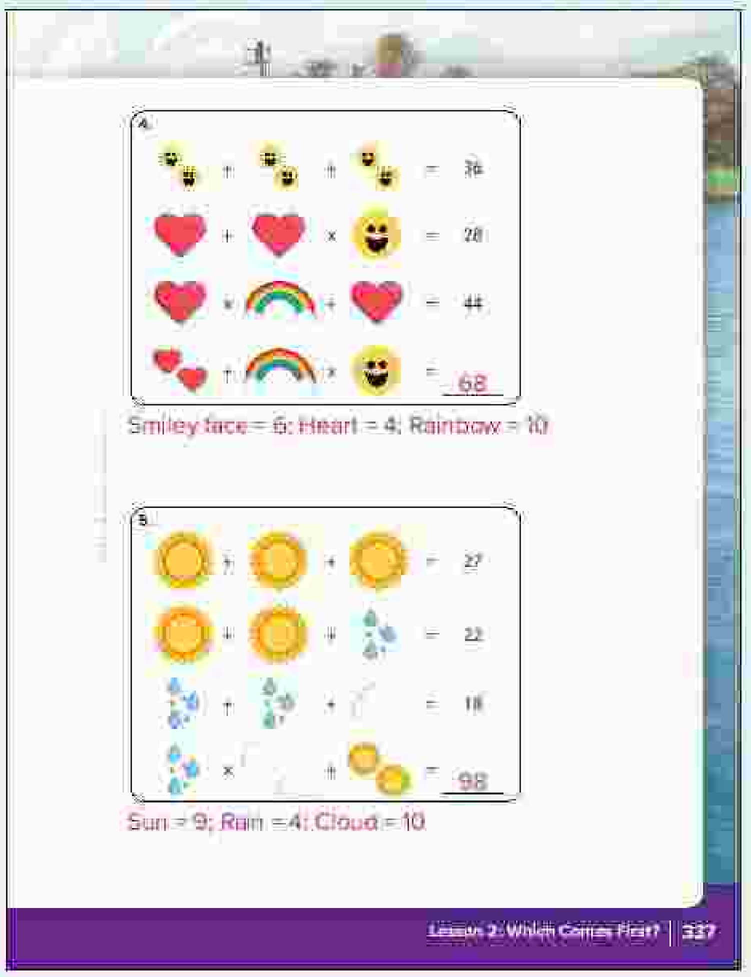
Trapezium = 9; Pentagon = 8; Circle = 5

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11. Ask students to continue working to solve Problem 1. Remind students to follow the order of operations.
12. Once students have finished Problem 1 (or if students are stuck), ask them to discuss the strategies they used. Go over the answers together.
13. After clearing up misconceptions and answering students' clarifying questions, allow students to work in small groups to solve Problems 2–5.

    TEACHER NOTE: Some of the puzzles have two pictures grouped together in one problem. This means to double the value of that picture.

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CONNECT (7 min)

Writing About Math

Direct students to Lesson 2 CONNECT Writing About Math and ask them to respond to the prompt.

Answer Key for Writing About Math:
Students should mention that the order of operations is important because doing operations in a different order changes the answers. Having everyone follow the same order of operations ensures that everyone gets the same answer to a problem with more than one operation.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to share their thinking about the order of operations with the class. What is still confusing? How did they overcome challenges when solving the picture puzzles?

PRACTICE

Direct students to Lesson 2 PRACTICE and have them complete the problems. Address student errors and misconceptions around very large numbers.

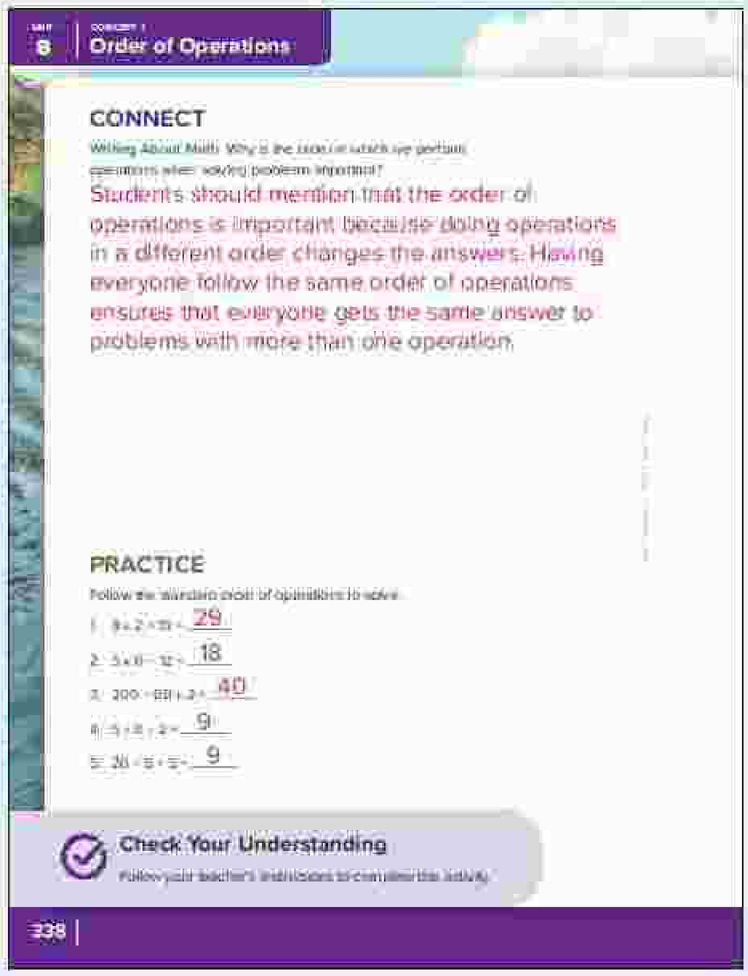
Check Your Understanding

Follow the standard order of operations to solve.

1. 3 × 16 − 4 = 44
2. 5 + 5 + 5 x 4 = 30
3. 9 × 6 − 10 = 44
4. 14 ÷ 7 + 20 = 22
5. 20 + 14 ÷ 7 = 22

PRINT

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UNIT 8 | CONCEPT 1 Order of Operations

CONNECT

Students should mention that the order of operations is important because doing operations in a different order changes the answers. Having everyone follow the same order of operations ensures that everyone gets the same answer to problems with more than one operation.

PRACTICE

1. 29
2. 18
3. 40
4. 9
5. 9

Check Your Understanding

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Materials List

- Order of Operations anchor chart (from Lesson 2)

Photo Credit: [illegible] / Shutterstock.com

DIGITAL



Lesson 3
Order of Operations

Quick Code
egmt4095

LESSON 3
Order of Operations

Lesson Overview

In this lesson, students follow the order of operations to solve equations with multiple operations. This practice is essential in helping students remember and apply the order of operations as they seek accuracy and fluency in computation.

Lesson Essential Questions

- What strategies can be used to compute answers?
- Why does the order of operations in multistep problem-solving matter?

Learning Objective

In this lesson

- Students will use the order of operations to solve equations with multiple operations.

Grade-Level Standards

4.C.1.f Follow the standard order of operations to solve equations with multiple operations.

Vocabulary Check-In

Review vocabulary as needed.

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ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may always try to complete the calculations from left to right without looking carefully at the operations.
- Students may have difficulty understanding the order of the steps when working through an equation with multiple operations.

Which Does Not Belong?

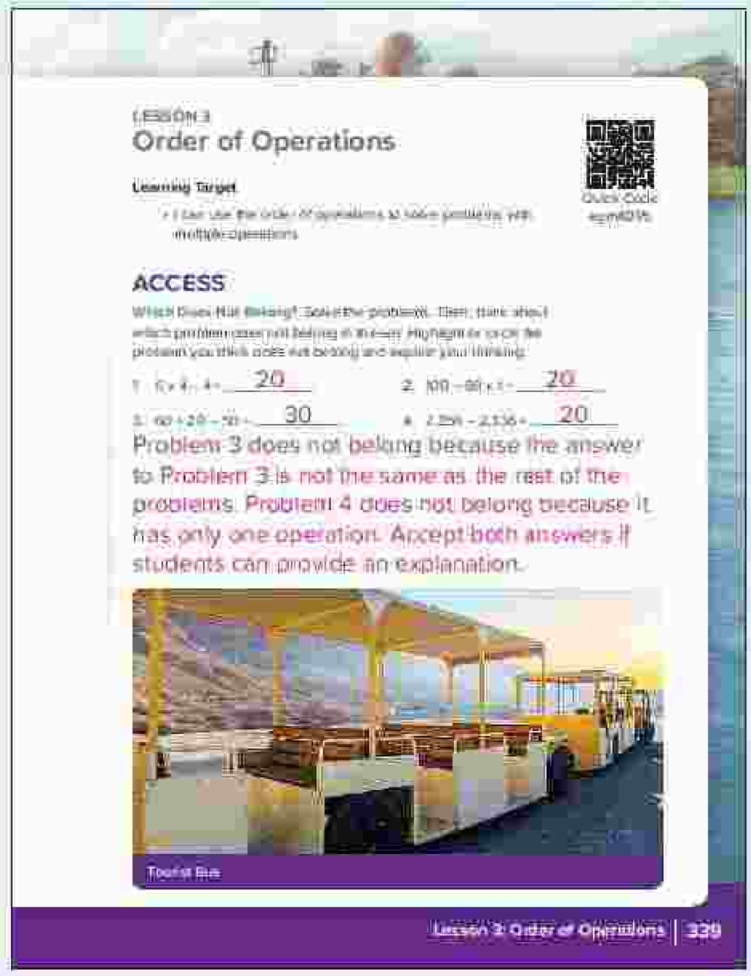
1. Direct students to Lesson 3 ACCESS Which Does Not Belong? and go over the directions together. Be sure students understand the different steps.
2. Ask students to work independently to complete the activity.
3. After about 5 minutes, ask students to share their responses with a partner. Then, ask volunteers to share their thinking with the class.

Answer Key for Which Does Not Belong?:
Problem 3 does not belong because the answer to Problem 3 is not the same as the rest of the problems. Problem 4 does not belong because it has only one operation. Accept both answers if students can provide an explanation.

1. $6 \times 4 - 4 = 20$
2. $100 - 80 \times 1 = 20$
3. $60 + 20 - 50 = 30$
4. $2,356 - 2,336 = 20$

PRINT

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LESSON 3

Order of Operations

Learning Target

Quick Code

ACCESS

1. 20
2. 20
3. 30
4. 20

Problem 3 does not belong because the answer to Problem 3 is not the same as the rest of the problems. Problem 4 does not belong because it has only one operation. Accept both answers if students can provide an explanation.

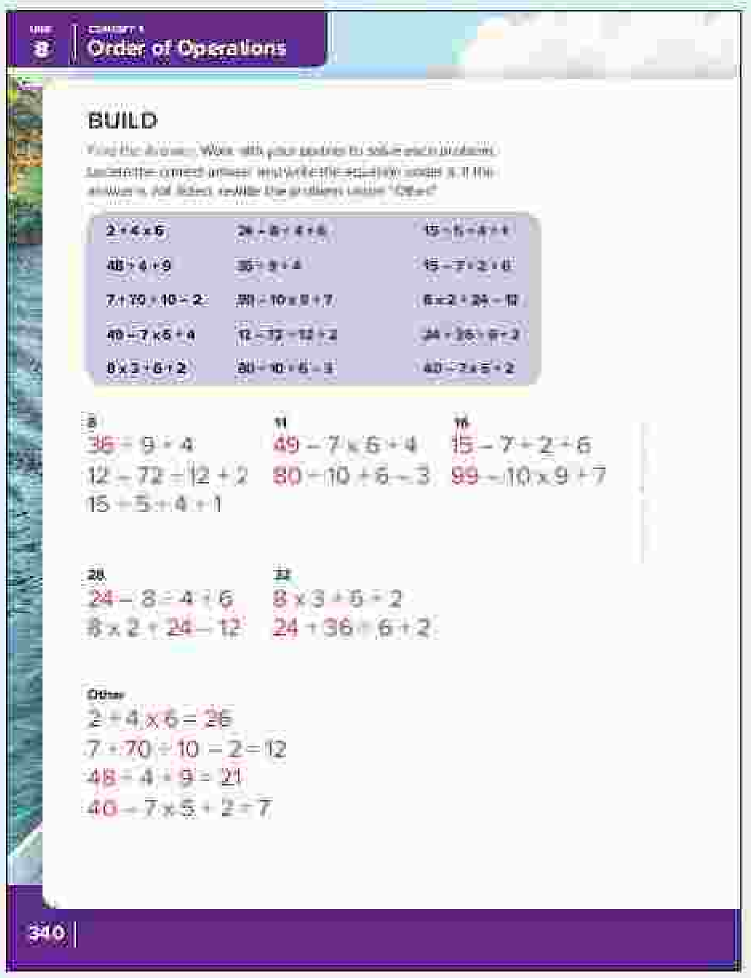
Tourist Bus

Lesson 3: Order of Operations | 339

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Unit 8 | Concept 1
Order of Operations

BUILD

2 + 4 x 6	24 − 8 ÷ 4 + 6	15 ÷ 5 + 4 + 1
48 ÷ 4 + 9	36 ÷ 9 + 4	15 − 7 + 2 + 6
7 + 70 ÷ 10 − 2	99 − 10 x 9 + 7	8 x 2 + 24 − 12
49 − 7 x 5 + 4	12 − 72 ÷ 12 + 2	24 + 36 ÷ 6 + 2
8 x 3 + 6 + 2	80 − 10 + 6 − 3	40 − 7 x 5 + 2

8
36 ÷ 9 + 4
12 − 72 ÷ 12 + 2
15 ÷ 5 + 4 + 1

11
49 − 7 x 5 + 4
80 − 10 + 6 − 3

16
15 − 7 + 2 + 6
99 − 10 x 9 + 7

28
24 − 8 ÷ 4 + 6
8 x 2 + 24 − 12

32
8 x 3 + 6 + 2
24 + 36 ÷ 6 + 2

Other
2 + 4 x 6 = 26
7 + 70 ÷ 10 − 2 = 12
48 ÷ 4 + 9 = 21
40 − 7 x 5 + 2 = 7

340

BUILD (40 min)

Working Left to Right (15 min)

1. Write 3 × 9 − 7 = _______ on the board. Ask students to work with their Shoulder Partner to solve the problem.
2. Point out to students that when following the order of operations, it is important to work left to right. Once students solve 3 × 9, they should solve 27 − 7 and not 7 − 27.
3. Write 10 × 3 × 9 − 7 = _______ on the board. Ask students to talk to their Shoulder Partner about how this problem is different from the first problem and them solve the problem.
4. Ask students to share their answers and explain their thinking. (Do not reveal the correct answer yet.)
5. Explain to students that the order of operations states that multiplication and division must be performed first, but that they must also be performed from left to right. So, 10 × 3 = 30, 30 × 9 = 270, and 270 − 7 = 263.
6. Write 50 + 42 ÷ 6 − 12 = _______ on the board. Ask students to give a Thumbs-Up when they think they know what to do first to solve the problem.
   Since there is division in this problem, students should solve 42 ÷ 6 first.
7. Rewrite the problem as 50 + 7 − 12 = _______ below the original problem.
8. Ask students to give a Thumbs-Up when they think they know what to do next. Explain to students that the order of operations states that addition and subtraction must also be performed from left to right.
   Therefore, the next step is 50 + 7.
9. Rewrite 57 − 12 = _______ below the last problem.
10. Ask students to solve the problem and give a Thumbs-Up when they have the answer.
    Following the order of operations, 50 + 42 ÷ 6 − 12 = 45.

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Find the Answer (25 min)

1. Direct students to Lesson 3 BUILD Find the Answer. Explain to students that some of the problems have the same answer. Ask students to work with a partner to solve the problems and rewrite each problem under its answer. If the answer is not listed, students should write the problem under "Other."
2. Allow partners to work for about 5 minutes, and then have students find a new partner to work with. Partners should compare their answers so far and continue working for another 5 minutes.
3. Ask students to return to their own seats and reflect on the activity. Ask students if they always agreed with their partner's answers. Remind students that this is why we have the order of operations. It ensures that everyone gets the same answer when they solve a problem with more than one operation. If there is time, go over the problems that students wrote under "Other."

Answer Key for Find the Answer:

8
$36 \div 9 + 4 = 8$
$12 - 72 \div 12 + 2 = 8$
$15 \div 5 + 4 + 1 = 8$

11
$49 - 7 \times 6 + 4 = 11$
$80 \div 10 + 6 - 3 = 11$

16
$15 - 7 + 2 + 6 = 16$
$99 - 10 \times 9 + 7 = 16$

28
$24 - 8 \div 4 + 6 = 28$
$8 \times 2 + 24 - 12 = 28$

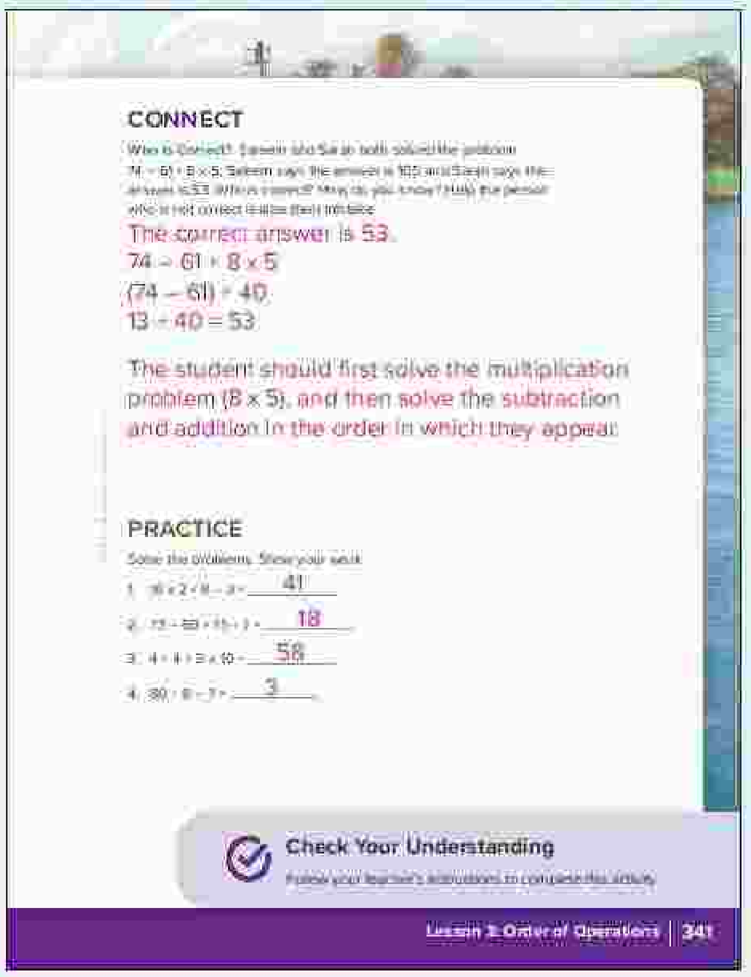
32
$8 \times 3 + 6 + 2 = 32$
$24 + 36 \div 6 + 2 = 32$

Other
$2 + 4 \times 6 = 26$
$7 + 70 \div 10 - 2 = 12$
$48 \div 4 + 9 = 21$
$40 - 7 \times 5 + 2 = 7$

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CONNECT (7 min)

Who Is Correct?

Ask students to turn to Lesson 3 CONNECT Who Is Correct? and respond to the prompt.

Answer Key for Who Is Correct?:

The correct answer is 53.

$74 - 61 + 8 \times 5$

$(74 - 61) + 40$

$13 + 40 = 53$

The student should first solve the multiplication problem (8×5), and then solve the subtraction and addition in the order in which they appear.

WRAP-UP (3 min)

Let's Chat About Our Learning

Ask some students to share their thinking about the CONNECT problem with the class. If necessary, review the order of operations and the rule of completing computation from left to right.

PRACTICE

Direct students to Lesson 3 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve the problems. Show your work.

1. $190 \div 10 + 5 + 4 = 28$
2. $36 - 15 + 18 \div 3 = 27$
3. $13 + 7 - 20 \div 5 = 16$
4. $35 + 12 - 4 \times 3 = 35$

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LESSON 4
The Order of Operations and Story Problems

Lesson Overview

In this lesson, students apply what they have learned about the order of operations to represent and solve multistep story problems.

Lesson Essential Questions

- Why does the order of operations in multistep problem-solving matter?
- How can we write equations to represent information in multistep story problems?

Learning Objectives

In this lesson

- Students will use the order of operations to solve equations with multiple operations.
- Students will write and solve an equation to represent a multistep story problem.

Grade-Level Standards

4.C.1.d Solve multistep story problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.i Use letters in equations to represent unknown quantities.

4.C.1.f Follow the standard order of operations to solve equations with multiple operations.

Vocabulary Check-In

efficient, parentheses

Materials List

- Order of Operations anchor chart

DIGITAL



Lesson 4
The Order of Operations and Story Problems

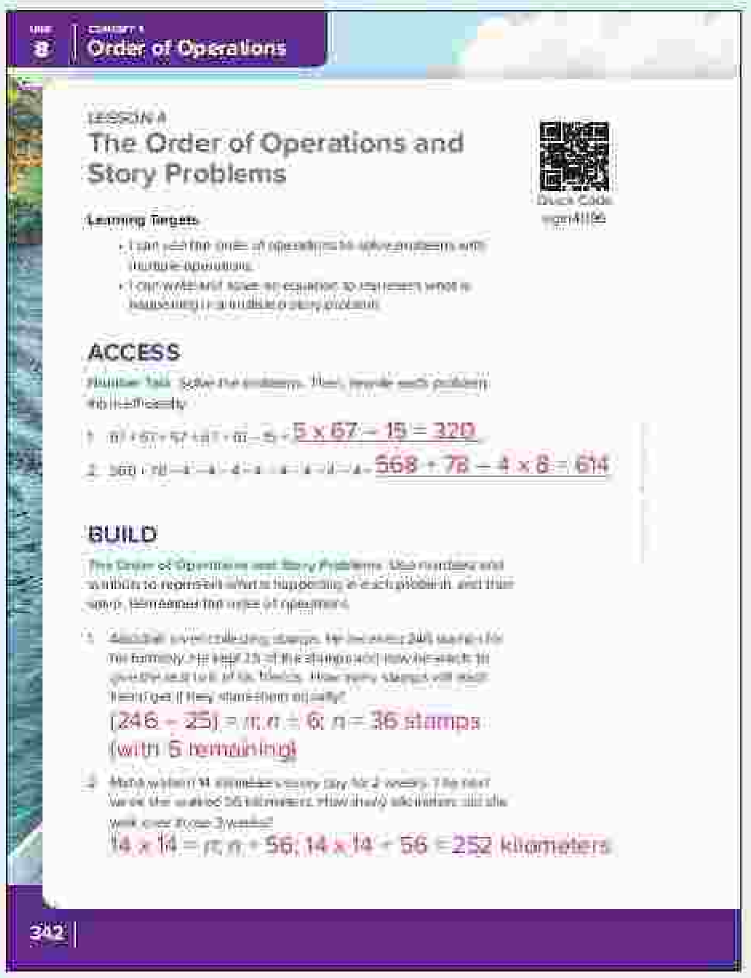
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UNIT 8 | CONCEPT 1 Order of Operations

LESSON 4

The Order of Operations and Story Problems

Quick Code

Learning Targets

- [illegible]
- [illegible]

ACCESS

[illegible]

1. [illegible] $5 \times 67 - 15 = 320$
2. [illegible] $568 + 78 - 4 \times 8 = 614$

BUILD

[illegible]

1. [illegible] $(246 - 25) = n$; $n \div 6$; $n = 36$ stamps (with 5 remaining)
2. [illegible] $14 \times 14 = n$; $n + 56$; $14 \times 14 + 56 = 252$ kilometers

342

ACCESS (10 min)

COMMON MISCONCEPTIONS AND ERRORS

- Students may follow the order of operations without considering the context of the problem.
- Students may unnecessarily use parentheses to indicate what to do first in an equation. For example, they might write $25 \times 5 - 19$ as $(25 \times 5) - 19$. While this is not incorrect, this is not the most efficient way to write the equation.

Number Talk

1. Direct students to Lesson 4 ACCESS Number Talk. Remind students that they have talked about being efficient before. When we are efficient, we write and solve problems quickly, but accurately. Ask students to rewrite each problem so it can be solved more efficiently.
2. Give students a few minutes to rewrite the equations. If necessary, encourage students to focus on the repeated operations.
3. Ask students to share their thinking with their Shoulder Partner.
4. Ask volunteers to write their problems on the board. Ask if any students had different ideas on how to rewrite the equations and allow them to share their approach.
5. Ask students to discuss what they notice about the different equations.

Answer Key for Number Talk:

1. $5 \times 67 - 15 = 320$
2. $568 + 78 - 4 \times 8 = 614$

P4_Math_T2_U8_C1_TE.indd Page 631 28/06/21 9:11 AM f-0288with /130/DIS00002/work/indd/TE/Unit_8

BUILD (40 min)

The Order of Operations and Story Problems

1. Remind students that they have already learned a great deal of mathematics in the first half of the school year. They have learned how to solve complex addition, subtraction, multiplication, and division problems; how to apply the Associative Property of Addition and Multiplication; how to use different strategies for solving story problems; how to use letters to represent unknowns in equations; how to find remainders in division problems; and how to apply the order of operations. Students should feel proud of all they have learned. Today, they will put all of those skills together to solve problems.
2. Direct students to Lesson 4 BUILD The Order of Operations and Story Problems. Explain to students they will be using the order of operations to represent what is happening in each story problem.
3. Remind students about the Three Reads strategy and give them time to read Problem 1. The first time they read, they should think about what is happening in the situation. The next time they read, they should think about what the numbers are telling us. The third time they read, they should think about what they might need to do to solve the problem.
4. Ask students what happens first in the problem and how they might represent that using numbers and symbols.
   Abdullah has 246 stamps and keeps 25 of them. This can be represented as 246 − 25.
5. Write 246 − 25 = *n* on the board. Remind students that they can write a letter to represent missing numbers in problems.
6. Ask students to turn to their Shoulder Partner to discuss what happens next in the problem.
   Abdullah shares his stamps equally among 6 friends.

PRINT

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3. Ashraf has to take the bus to work. It takes 27 minutes to get to the bus stop near his job. Then, he has to walk for 12 minutes from the bus stop to his place of work. How many minutes does Ashraf spend going to work during a 5-day week?

   27 + 12 = *n*; *n* × 5; (27 + 12) × 5 = 195 or (27 × 5) + (12 × 15) = 195 minutes (or 3 hours and 15 minutes)

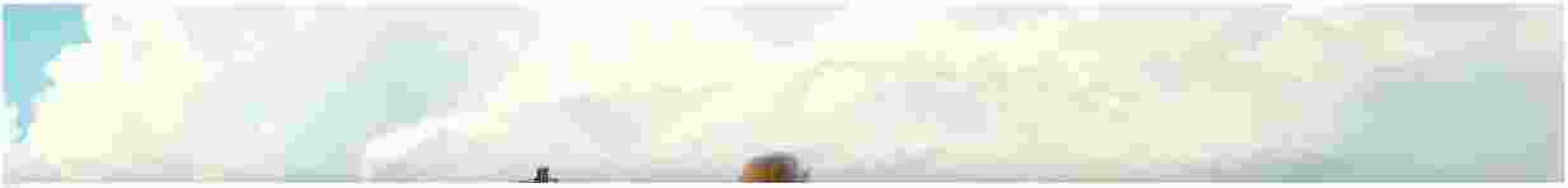
4. A group of tourists are taking a tour of Alexandria. There are 172 tourists and 8 tour guides in the group. They want to travel to the pyramids in microbuses. Each microbus fits 9 people. How many microbuses will they need in order to get everyone to the pyramids?

   172 + 8 = *n*; *n* ÷ 9; (172 + 8) ÷ 9 = 20 microbuses

Microbuses in the Desert

Lesson 4: The Order of Operations and Story Problems | 343

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7. Write $n \div 6$ on the board. Ask students to explain how this relates to the problem. The number n is how much is left over after he keeps some of the stamps. That amount will be shared among his 6 friends.
8. Write $246 - 25 \div 6$ on the board. Ask students to give a Thumbs-Up if they agree and a Thumbs-Down if they disagree that this equation represents what happens in the story problem. Ask a few students to share their thinking.
9. Explain that, although the problem appears to represent what happened in the problem, the order of operations states that the division portion must be solved first. However, the first thing that happened in the story was subtraction (keeping some of the stamps).
10. Remind students that, when they learned the Associative Property of Addition, they also learned that mathematicians use parentheses to indicate what to do first in a problem.
11. Direct students' attention to the Order of Operations anchor chart. The first operation on the chart involves parentheses. Operations in parentheses are solved first, even before multiplication or division. So, we can use parentheses to make sure the subtraction portion is solved first.
12. Write $(246 - 25) \div 6$ on the board. Ask students to solve the problem in their Student Edition. Ask a student to explain the answer (the number of shared stamps and the meaning of the remainder).
13. Ask students to work in pairs or small groups to solve Problems 2–5, writing equations that represent each story problem and follow the order of operations. Students may choose whether or not they use letters in their problems.
14. As students work, walk around and observe their problem-solving strategies. Ask questions to prompt their thinking, if needed. Take note of students who may need additional instruction and support. If many students are struggling, stop and work with the class to solve each problem. Ask students to provide reasoning and next steps whenever possible.
15. With about 5 minutes left in BUILD, go over the equations and answers with students.

Answer Key for Order of Operations and Story Problems:

1. $(246 - 25) = n$; $n \div 6$; $n = 36$ stamps (with 5 remaining)
2. $14 \times 14 = n$; $n + 56$; $14 \times 14 + 56 = 252$ kilometers
3. $27 + 12 = n$; $n \times 5$; $(27 + 12) \times 5 = 195$ or $(27 \times 5) + (12 \times 15) = 195$ minutes (or 3 hours and 15 minutes)
4. $172 + 8 = n$; $n \div 9$; $(172 + 8) \div 9 = 20$ microbuses
5. $198 - 17 = n$; $(198 - 17) \div 6 = 30$ muffins (with 1 berry remaining)

TEACHER NOTE: Some students may be able to write efficient equations using parentheses, such as $(246 - 25) \div 6 = 36$ R5, but count as correct all work that accurately reflects the story problem and results in a correct answer.

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CONNECT (7 min)

Writing My Own Problem

1. Direct students to Lesson 4 CONNECT Writing My Own Problem and read the directions aloud. Discuss with students some ideas they could use to write their story problems (for example, food, people, games, toys, measurements, money).
2. Ask students to write a story problem that matches the numbers and symbols shown.

Answer Key for Writing My Own Problem:
Students' story problems will vary, but should be able to be solved by $(50 - 36) \div 4$.

TEACHER NOTE: Consider using this activity as a formative assessment to determine which students need additional instruction and support. Mastery is not expected at this time, but students' work will reveal misconceptions and errors that need to be corrected.

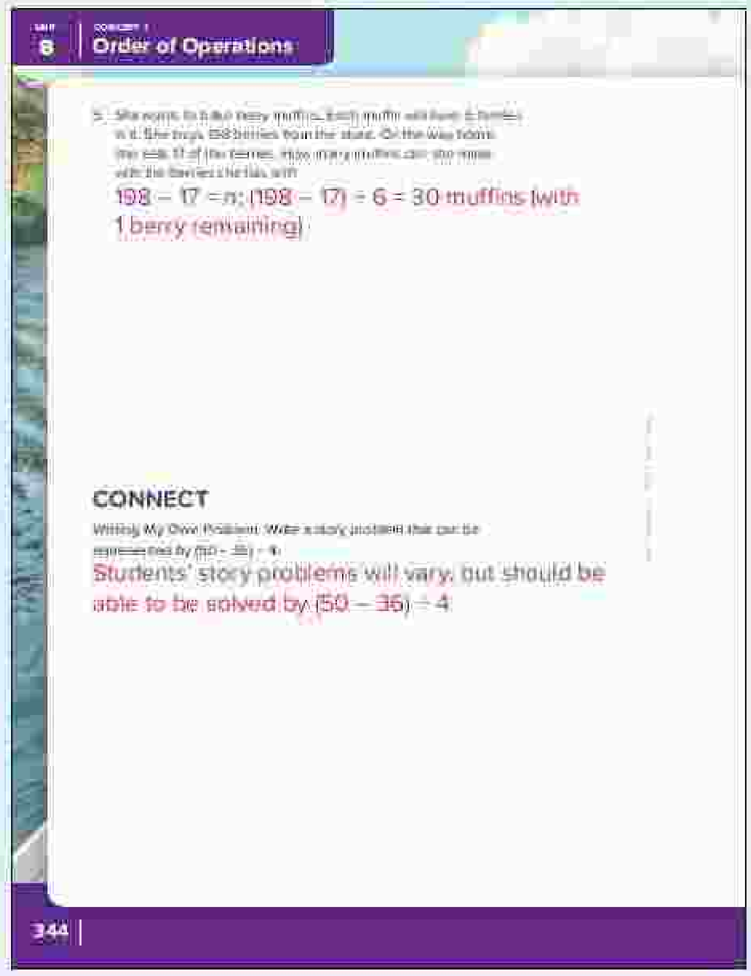
WRAP-UP (3 min)

Let's Chat About Our Learning

Ask students to discuss the challenges of writing a story problem to match a given equation. How does the order of operations help them write and solve these kinds of problems?

PRINT

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UNIT 8 | CONCEPT 1 Order of Operations

$198 - 17 = n$; $(198 - 17) \div 6 = 30$ muffins (with 1 berry remaining)

CONNECT

Students' story problems will vary, but should be able to be solved by $(50 - 36) \div 4$

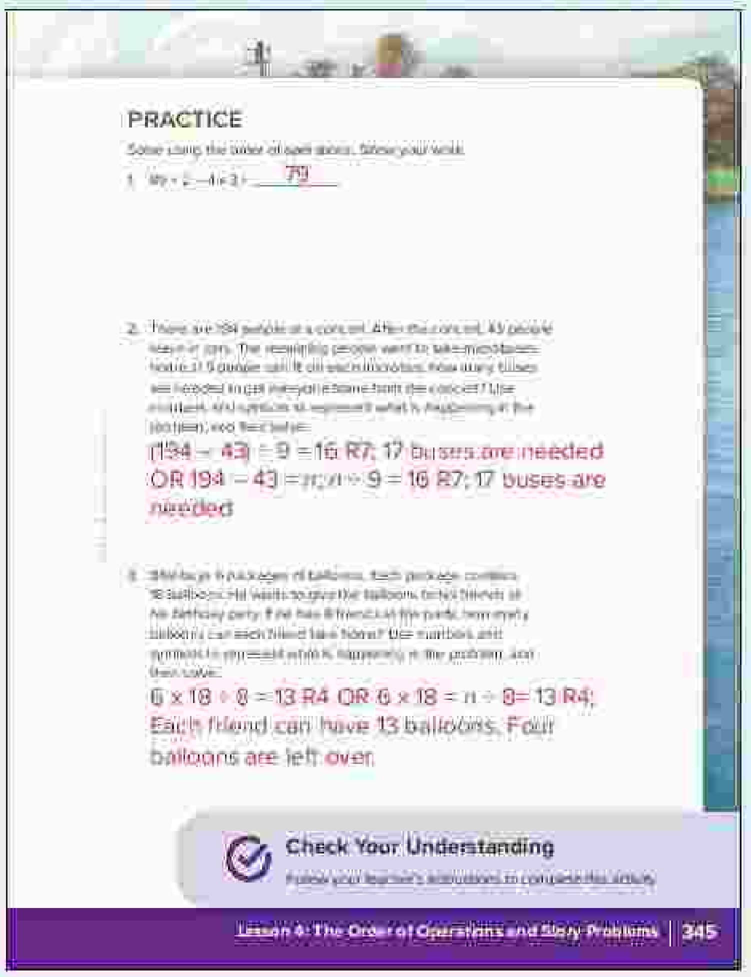
344

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PRACTICE

Solve using the order of operations. Show your work.

1. 79

2. (194 − 43) ÷ 9 = 16 R7; 17 buses are needed OR 194 − 43 = n; n ÷ 9 = 16 R7; 17 buses are needed

3. 6 × 18 ÷ 8 = 13 R4 OR 6 × 18 = n ÷ 8 = 13 R4; Each friend can have 13 balloons. Four balloons are left over.

PRACTICE

Direct students to Lesson 4 PRACTICE and have them complete the problems. Address student errors and misconceptions.

Check Your Understanding

Solve using the order of operations. Show your work.

1. 17 × (15 − 8) + 2 = 121
2. Mohammed ran 8 kilometers on Saturday and twice that amount on Sunday. He ran 6 kilometers less on Monday than he did on Sunday. How many kilometers did he run on Monday? Use numbers and symbols to represent what is happening in the problem, and then solve.
   8 × 2 − 6 = 10 kilometers OR 8 × 2 = n; n − 6 = 10 kilometers
3. There were 86 people on the pitch. Of the 86 people, 9 of them were coaches, and the rest wanted to play football. If they wanted to form teams of 11, how many teams could they make? Use numbers and symbols to represent what is happening in the problem, and then solve.
   (86 − 9) ÷ 11 = 7 teams OR 86 − 9 = n; n ÷ 11 = 7 teams

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Concept Check-In and Remediation

Lesson Overview

In this lesson, students work to correct misconceptions and errors from Concept 1 Understanding the Order of Operations. First, administer the Concept Check-In. Once you have reviewed the quiz results, choose remediation activities based on the needs of your students. Some recommendations are listed in the chart, but the needs of your particular students should inform your choices. Students may work independently, in pairs, or in a small group with the teacher.

Lesson Essential Questions

- Why does the order of operations in multistep problem-solving matter?
- How can we write equations to represent information in multistep story problems?
- What strategies can be used to compute answers?

Learning Objective

In this lesson

- Students will work to correct misconceptions and errors related to solving problems using the order of operations.

Grade-Level Standards

4.A.2 Use place value understanding and properties of operations to perform multidigit arithmetic.

4.C.1.d Solve multistep story problems posed with whole numbers using the four operations, including problems in which remainders must be interpreted.

4.C.1.d.i Use letters in equations to represent unknown quantities.

Materials List

- Materials may vary

DIGITAL



Concept Check-In and Remediation

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4.C.1.e Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

4.C.1.f Follow the standard order of operations to solve equations with multiple operations.

Vocabulary Check-In

Review concept vocabulary as needed.

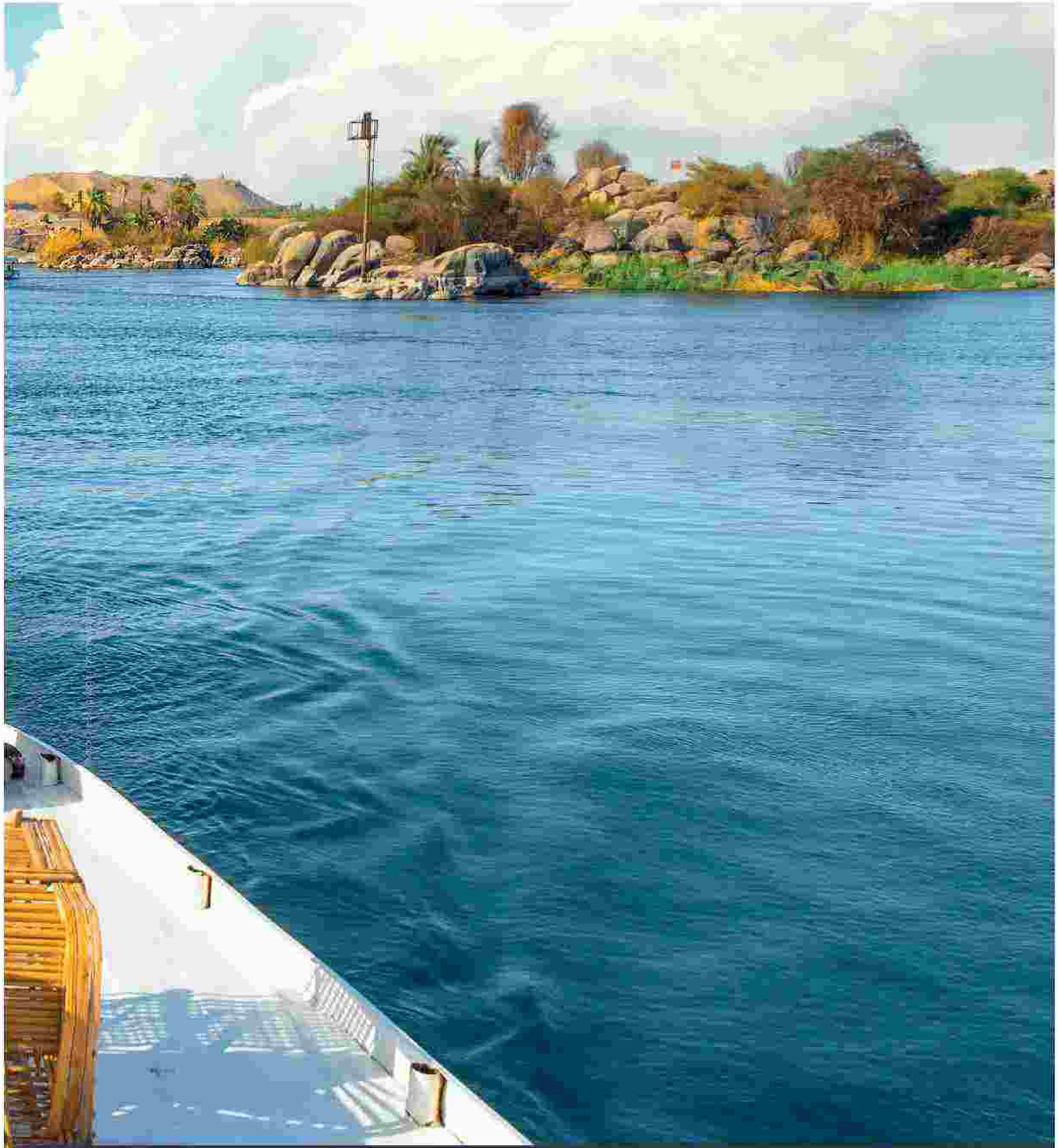
COMMON MISCONCEPTIONS AND ERRORS

- Students may always try to complete the calculations from left to right without looking carefully at the operations.
- Students may have difficulty understanding the order of the steps when working through an equation with multiple operations.
- Students may follow the order of operations without considering the context of the problem.
- Students may unnecessarily use parentheses to indicate what to do first in an equation. For example, they might write $25 \times 5 - 19$ as $(25 \times 5) - 19$. While this is not incorrect, this is not the most efficient way to write the equation.

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Remediation: Correcting Misconceptions

If . . .	Then . . .
Students have difficulty understanding the order of the steps when working through an equation with multiple operations.	Review Lessons 2 and 3. Consider having students write numbers above the equation to help the determine which operation comes first, second, and so on. It may also help students to highlight what they need to complete first in an equation, and then use their finger to track how they will solve the equation from left to right.
If . . .	**Then . . .**
Students do not consider the context of the problem when writing equations to represent multistep story problems.	Review Lesson 4. Consider having students reread problems, visualize, or act out what is happening in the problem, and then write the steps they would need to use to solve the problem. Students may also benefit from doing a line-by-line analysis of the problem. Provide additional practice using the Three Reads problem-solving strategy.



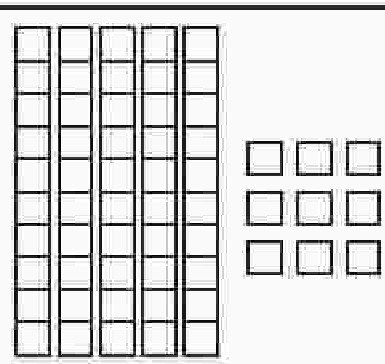
Primary 4
Resources

- Lesson Blackline Masters
- Glossary
- Index

Unit 1, Lesson 1
Review Digit, Numeral, Number

Sorting Cards

Instructions: Photocopy and cut apart or recreate on large squares of paper.

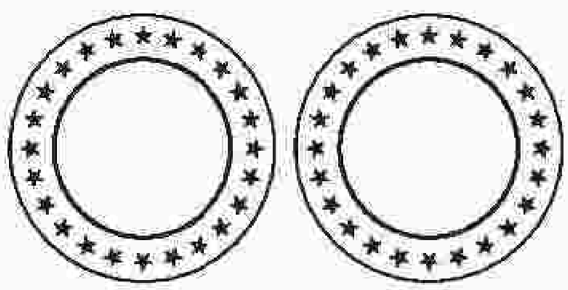
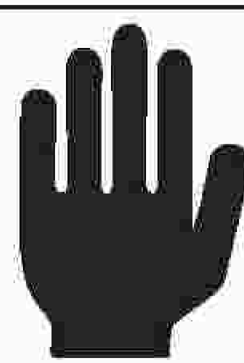
two hundred	35,646,788
three thousand, four hundred twelve	5
	0
	forty-nine

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Unit 1, Lesson 1
Review Digit, Numeral, Number

Sorting Cards, *continued*

Instructions: Photocopy and cut apart or recreate on large squares of paper.

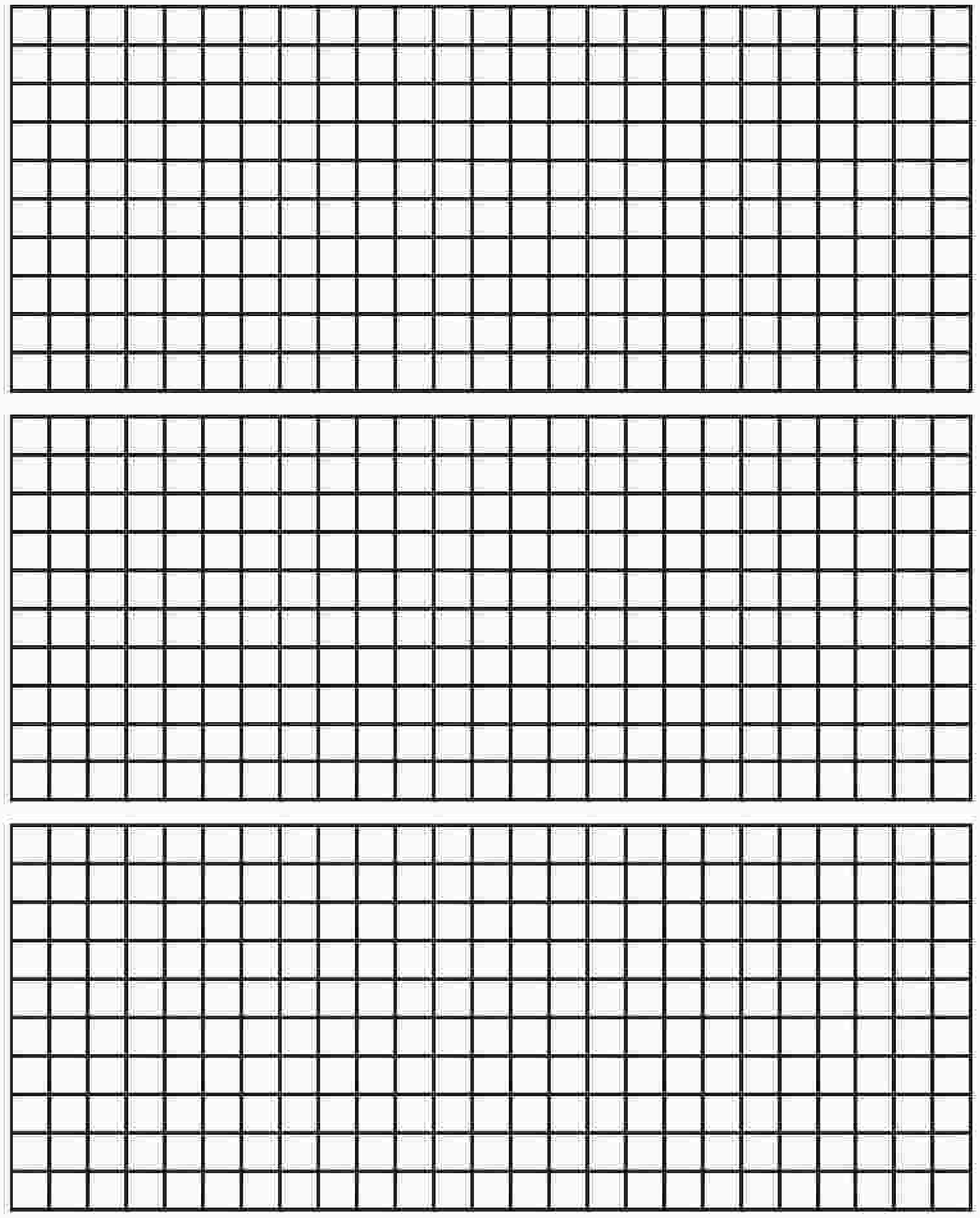
45,646	70,000,000
	
1	eight
one million	**Answer Key:** two hundred; 35,646,788; three thousand, four hundred twelve; 5; forty-nine; 45,646; 70,000,000; 1; eight; one million

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Unit 1, Lesson 3
Changing Values

Tens Rods

Instructions: Photocopy and cut apart along the vertical lines to create Tens rods. Each student will need two rods.



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Unit 1, Lesson 3
Changing Values

Large Digit Cards

Instructions: Photocopy one set for the teacher and cut apart.

1	2	3
4	5	6
7	8	9

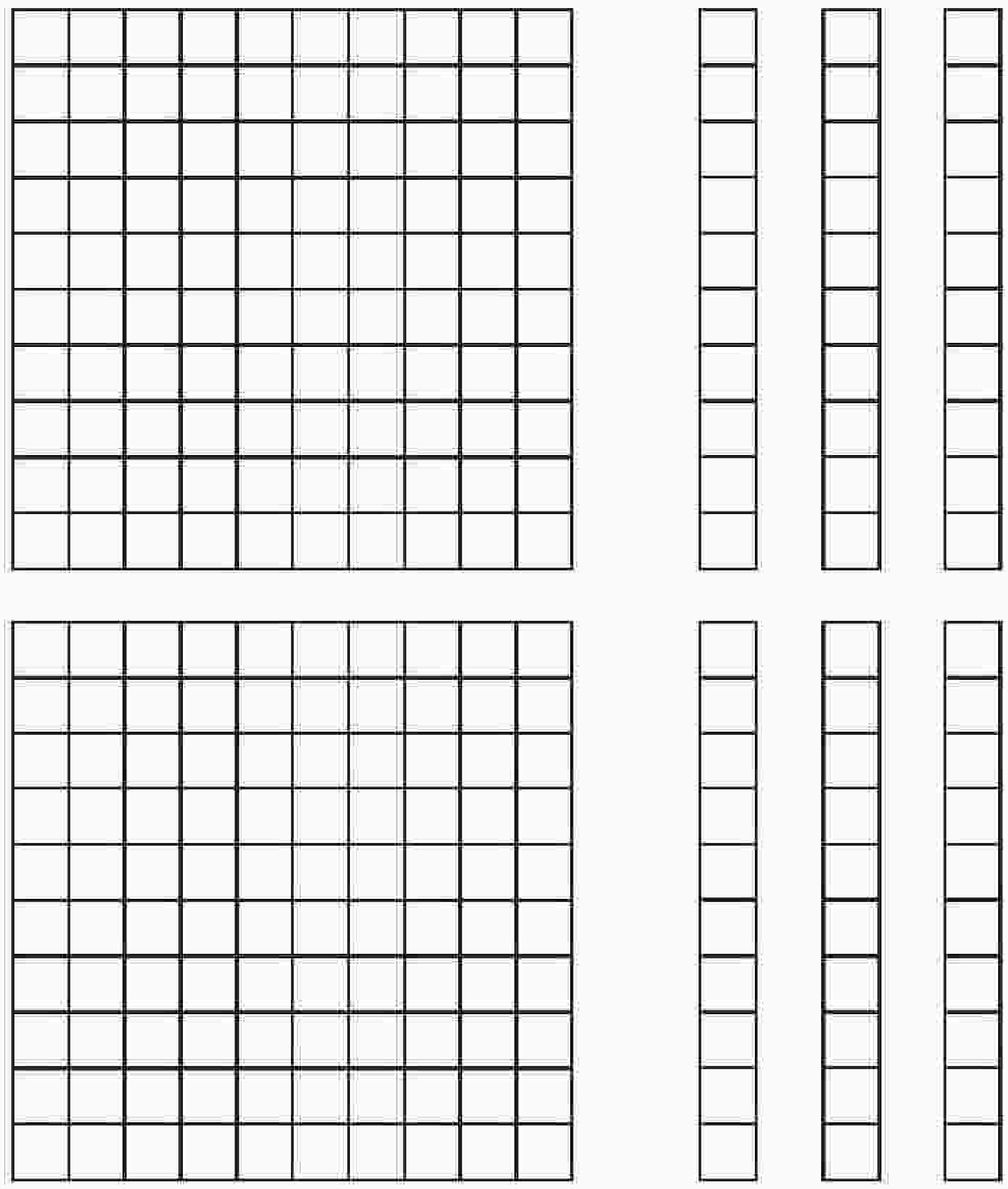
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Unit 1, Lesson 4
Review Comparing Values

Large Base Ten Manipulatives

Instructions: Photocopy and cut out one set for the teacher.

Hundreds flats = 100
Tens rods = 10
Cut some Tens rods into squares to create Ones cubes.



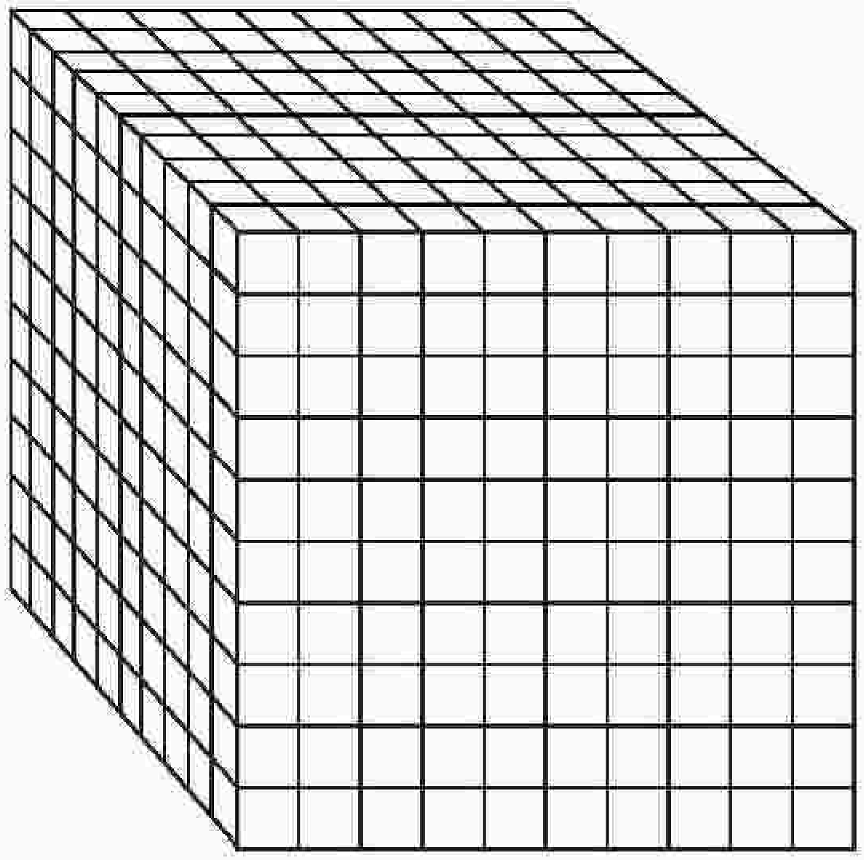
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Unit 1, Lesson 4
Review Comparing Values

Large Base Ten Manipulatives, *continued*

Instructions: Photocopy and cut out one set for the teacher.

Cube = 1,000



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Unit 1, Lesson 6
Composing and Decomposing

We Have, Who Has? Cards

Instructions: Photocopy and cut apart.

★ **We have** 1,223,643,509 **Who has** Six milliard, two hundred twenty million, four hundred sixteen thousand, one?	**We have** 6,220,416,001 **Who has** A number with a digit worth 800,000?
We have 78,812,934 **Who has** The word form of 584,453,238?	**We have** Five hundred eighty-four million, four hundred fifty-three thousand, two hundred thirty-eight **Who has** The expanded form of 404,000,040?
We have 400,000,000 + 4,000,000 + 40 **Who has** A number with a digit worth 10?	**We have** 6,230,904,010 **Who has** 10,000 more than 7,323,134,000?
We have 7,323,144,000 **Who has** Four million, six hundred thousand, nine hundred ninety-nine?	**We have** 4,600,999 **Who has** The expanded form for 5,333,090,100?

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Unit 1, Lesson 6
Composing and Decomposing

We Have, Who Has? Cards, *continued*

Instructions: Photocopy and cut apart.

We have 5,000,000,000 + 300,000,000 + 30,000,000 + 3,000,000 + 90,000 + 100 **Who has** The standard form for sixty-seven thousand, four hundred and seventy-seven?	**We have** 67,477 **Who has** 100,000 less than 543,830?
We have 443,830 **Who has** Three milliard, four hundred twenty-eight million, six hundred thousand, one?	**We have** 3,428,600,001 **Who has** A number with a digit worth 2,000,000,000?
We have 2,000,600,061 **Who has** Five hundred twenty thousand, four hundred two	**We have** 520,402 **Who has** Six milliard, nine million, two hundred thousand, ninety-nine
We have 6,900,200,099 **Who has** The expanded form of 7,530,003,523?	★ **We have** 7,000,000,000 + 500,000,000 + 30,000,000 + 500 + 20 + 3 **Who has** A number with a digit worth 1,000,000,000?

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Unit 1, Lesson 6
Composing and Decomposing

We Have, Who Has? Cards

Answer Key: The game begins and ends with the card with the star.

1. We have 1,223,643,509 Who has Six milliard, two hundred twenty million, four hundred sixteen thousand, one? ★	9. We have 5,000,000,000 + 300,000,000 + 30,000,000 + 3,000,000 + 90,000 + 100 Who has the standard form for sixty-seven thousand, four hundred and seventy-seven?
2. We have 6,220,416,001 Who has a number with a digit worth 800,000?	10. We have 67,477 Who has 100,000 less than 543,830?
3. We have 78,812,934 Who has the word form of 584,453,238?	11. We have 443,830 Who has Three milliard, four hundred twenty-eight million, six hundred thousand, one?
4. We have Five hundred eighty-four million, four hundred fifty-three thousand, two hundred thirty-eight Who has the expanded form of 404,000,040?	12. We have 3,428,600,001 Who has a number with a digit worth 2,000,000,000?
5. We have 400,000,000 + 4,000,000 + 40 Who has a number with a digit worth 10?	13. We have 2,000,600,061 Who has Five hundred twenty thousand, four hundred two
6. We have 6,230,904,010 Who has 10,000 more than 7,323,134,000?	14. We have 520,402 Who has Six milliard, nine million, two hundred thousand, ninety-nine
7. We have 7,323,144,000 Who has Four million, six hundred thousand, nine hundred ninety-nine?	15. We have 6,900,200,099 Who has the expanded form of 7,530,003,523?
8. We have 4,600,999 Who has the expanded form for 5,333,090,100?	16. We have 7,000,000,000 + 500,000,000 + 30,000,000 + 500 + 20 + 3 Who has a number with a digit worth 1,000,000,000? ★

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Unit 1, Lesson 7
Review Comparing Really Big Numbers

Comparison Symbols

Instructions: Photocopy and cut out one set for the teacher.

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<

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Unit 2, Lesson 1
Properties of Addition

Properties of Addition Anchor Chart

Instructions: Re-create a large version of this anchor chart to display in the classroom.

Properties of Addition

Additive Identify Property of Addition

- When you add zero to any number, the number stays the same.
  - Example: 26 + 0 = 26 or 0 + 26 26

Commutative Property of Addition

- No matter what order you add the numbers (addends), you get the same answer (sum).
  - Example: 9 + 4 + 1 = 14 and 1 + 4 + 9 = 14 and 4 + 9 + 1 = 14

Associative Property of Addition

- No matter how you group the numbers (addends), you get the same answer (sum).
  - Example: (7 + 3) + 5 = 15 and 7 + (3 + 5) = 15 and (5 + 7) + 3 = 15

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Unit 2, Lesson 1
Properties of Addition

Mathematics Tool Kit

Instructions: Re-create a large version of this anchor chart to display in the classroom.

Mathematics Tool Kit
• Replace large numbers in challenging problems with smaller numbers to understand the question.

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Unit 2, Lesson 2
Subtraction Strategies

Mental Math Strategies

Instructions: Photocopy or re-create a large version of this anchor chart to display in the classroom. Examples can be in a different color to make them easier to see. You will add more strategies to the anchor chart in upcoming lessons.

Strategy	Description
Front-End Estimation	**Add or subtract only the largest place values in each number to produce an estimate (that may not be close to the actual answer).** For example, in the problem 167 – 83, you can think 100 – 80 = 20.
Rounding	**Select one place value for each number. Determine which multiple of 10, 100, 1,000 (and so on) it is closest to and then add or subtract for a more accurate estimate.** For example, in the problem 167 – 83, you can think 170 – 80 = 90 (a far more accurate estimate).
Compensation	**Regroup the numbers in a problem to create numbers that are easier to add or subtract mentally.** For example, with 59 + 22, you can think "60 + 22 is 82 but I added one too many so the sum will be 1 less, or 81". Or for subtraction, with 17 – 9, you can think "17 – 10 is 7, but I subtracted 1 too many, so the difference is one more, or 8."
Break Up and Bridge	**Break up the number being added or subtracted into numbers that are easier to add or subtract mentally, then go back and add or subtract the missing quantities.** For example, with 92 – 26, you can think "92 – 20 is 72 and then take 6 more away is 66," or for 537 + 208, you can think, "500 + 200 = 700; 30 + 0 = 30; and 7 + 8 = 15. 700 + 30 + 15 = 745."
Add to Subtract	**Count up from the subtrahend to the minuend.** For example, with 92 – 67, you can think "67 + 3 = 70; 70 + 20 = 90; 90 + 2 = 92. 3 + 20 + 2 = 25, 92 – 67 = 25.

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Unit 2, Lesson 2
Subtraction Strategies

Thinking Like a Mathematician

Instructions: Photocopy or re-create a large version of this anchor chart to display in the classroom.

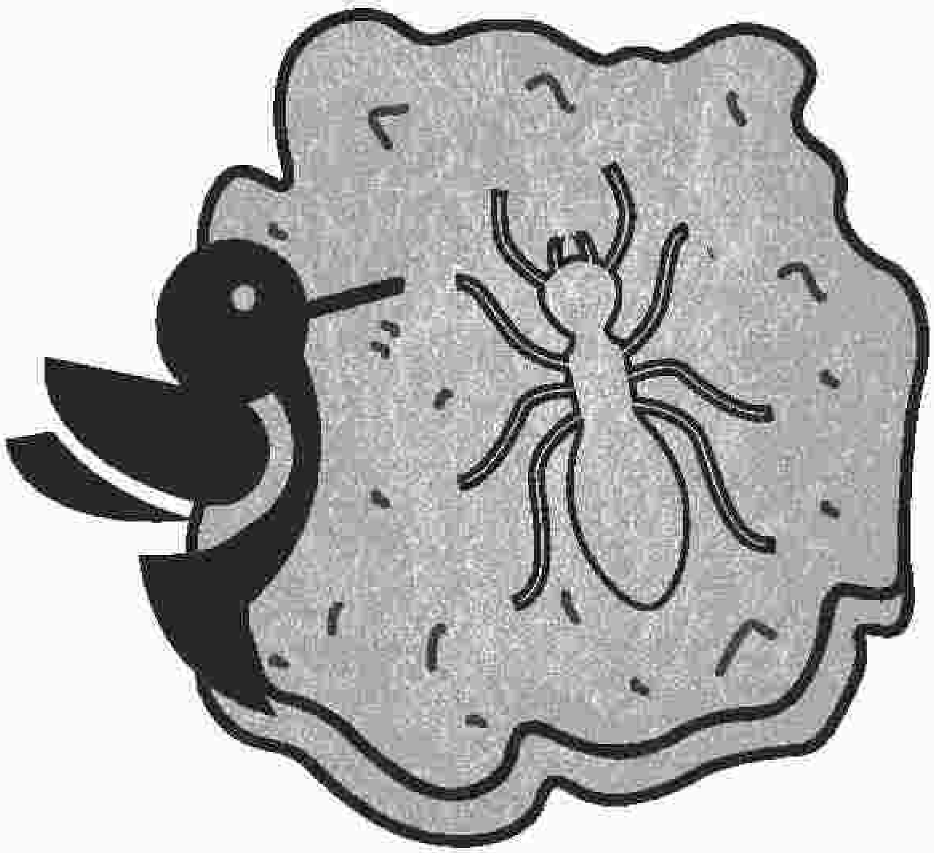
Good Mathematicians . . .	
Persevere	I can make sense of problems and keep trying.
Represent	I can show what the problem is asking in pictures, numbers, and words.
Explain	I can explain my thinking and work and compare my strategy with others.
Model	I can apply what I know about math in different problems.
Use Tools	I can choose appropriate tools and use them effectively to solve problems.
Are Accurate	I work carefully and check my work to make sure it is accurate and precise.
Use Structure	I can find patterns and use what I know to solve new problems.
Notice Patterns	I can use what I notice to explain rules and shortcuts when solving problems.

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Unit 3, Lesson 7
Scaled Measurements

Largest Fossilized Ant: *Titanomyrma lubei*

This ancient ant fossil was named titan for its size, *myrma* for the Greek word for "ant," and *lubei* for the fossil collector who discovered the specimen, Louis Lube.



The largest ant species ever recorded was discovered in fossilized remains in Wyoming, USA. The insect, named *Titanomyrma lubei* for its incredible length, was about 5 cm long and comparable in size to a modern hummingbird. This image shows a hummingbird next to the fossil for reference. (A modern hummingbird is about 9 cm long.)

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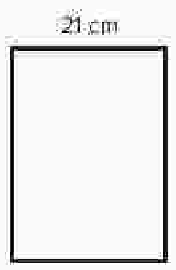
Unit 4, Lesson 3
Something is Missing!

SCOOT Cards

Instructions: Photocopy and cut apart one card per pair of students.

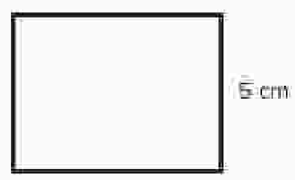
1. The perimeter of the paper is 102 cm. What is the width?

Width =



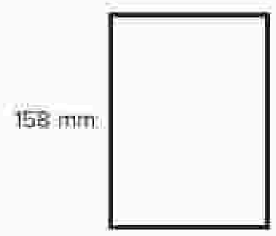
2. The perimeter of the candy bar is 36 cm. What is the length?

Length =



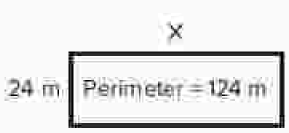
3. The perimeter of the cell phone is 472 mm. What is the width?

Width =



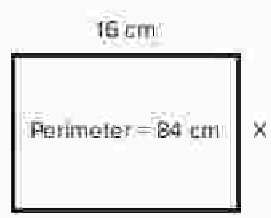
4. Find the missing length.

X =



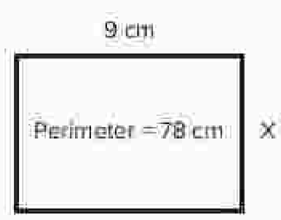
5. Find the missing width of the rectangle.

X =



6. Find the missing dimension of the rectangle.

X =



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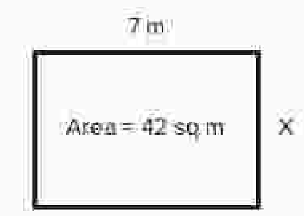
Unit 4, Lesson 3
Something is Missing!

SCOOT Cards, *continued*

Instructions: Photocopy and cut apart one card per pair of students.

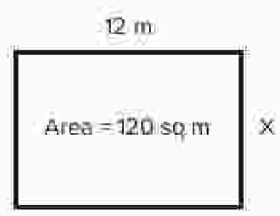
7. Find the missing dimension of the rectangle.

X =

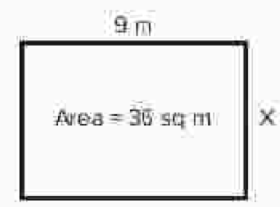


8. Find the missing dimension of the rectangle.

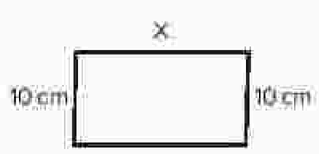
X =



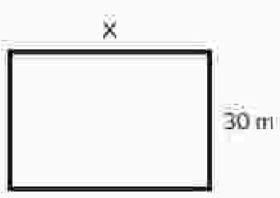
9. Seif was building a rectangular garden box to enclose 36 square meters of dirt. The length was 9 meters. How wide should the box be?



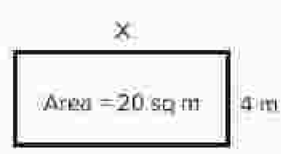
10. Wafaa had 60 cm of ribbon. She wants to put it around a rectangular doll blanket she made. If she puts 10 cm on each side as shown, how many cm will be along the width?



11. If a rectangular fence uses 126 meters of wire, how many meters were along each length?



12. Formica ants build ant mounds that cover about 20 square meters. If the mound was rectangular and had a width of 4 meters, what is the length?



Answer Key:

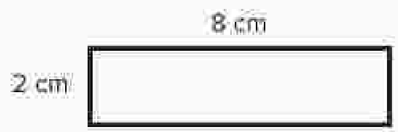
1. 30 cm
2. 13 cm
3. 78 mm
4. 38 m
5. 26 cm
6. 30 cm
7. 6 m
8. 10 m
9. 4 m
10. 20 cm
11. 33 m
12. 5 m

Unit 4, Lesson 4
Odd Shapes

Shape Cards

Instructions: Photocopy and cut out one card for each student.

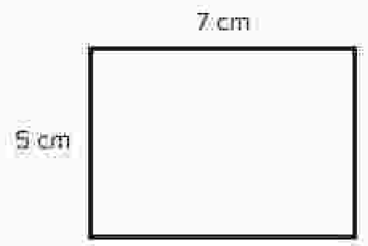
Shape 1



Perimeter =

Area =

Shape 2



Perimeter =

Area =

Shape 3



Perimeter =

Area =

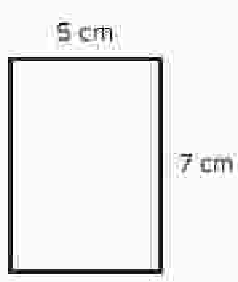
Shape 4



Perimeter =

Area =

Shape 5



Perimeter =

Area =

Shape 6



Perimeter =

Area =

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Unit 5, Lesson 1
Understanding Multiplicative Comparison

Teacher Paper Strip

Instructions: Photocopy, cut apart, and tape together into one 90-cm strip. (Use the tabs to tape or glue the strips together without losing length. The tabs should not show on your finished strip.)

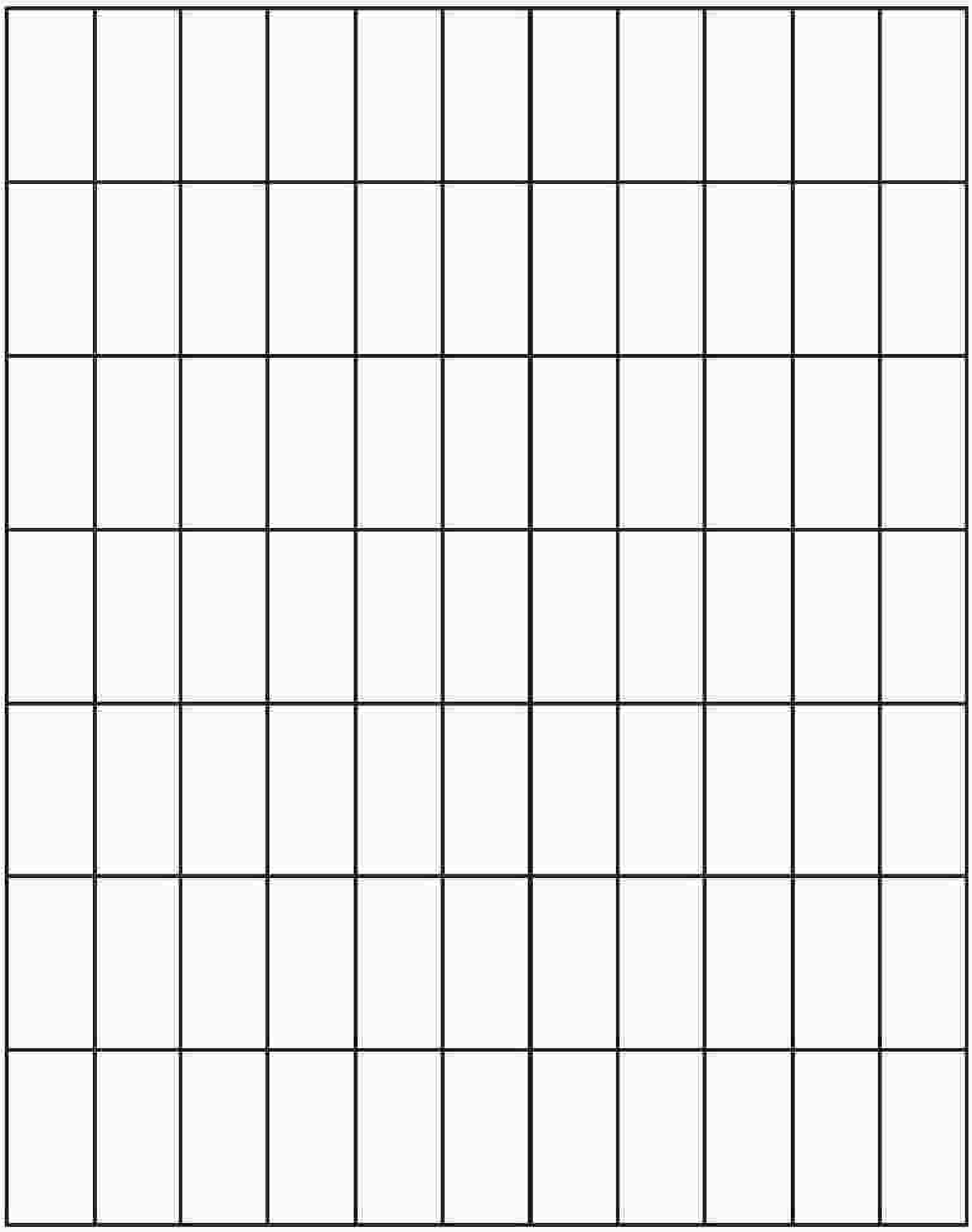
Tabs	for	tape	or	glue

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Unit 5, Lesson 1
Understanding Multiplicative Comparison

Student Paper Strips (for ACCESS)

Instructions: Photocopy and cut apart.



MTE_Egypt_TE_P4_T1_B.indd 20 22/07/21 11:32 AM

Unit 5, Lesson 1
Understanding Multiplicative Comparison

Student Tapes (for BUILD)

Instructions: Photocopy; give one set to each student.

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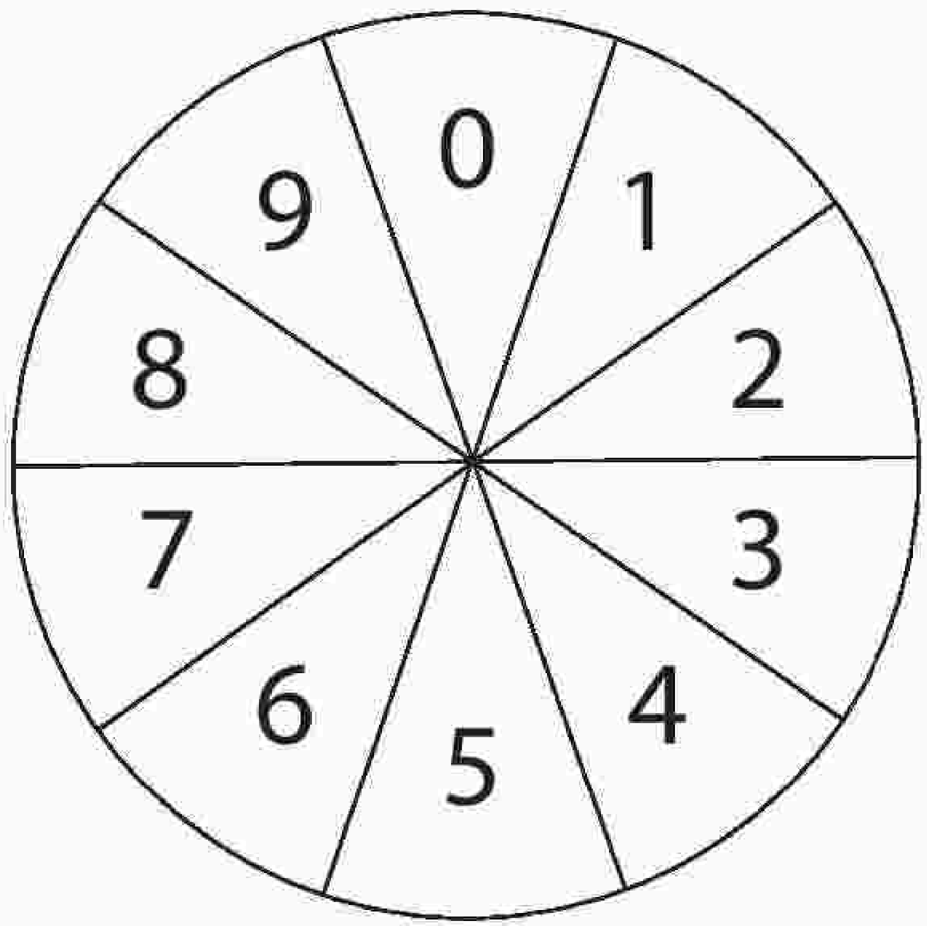
Unit 5, Lesson 4
Commutative Property of Multiplication

Extra Graph Paper

Unit 5, Lesson 6
Review Patterns in Multiplication

9 Spinner

Instructions: Photocopy one spinner per small group.

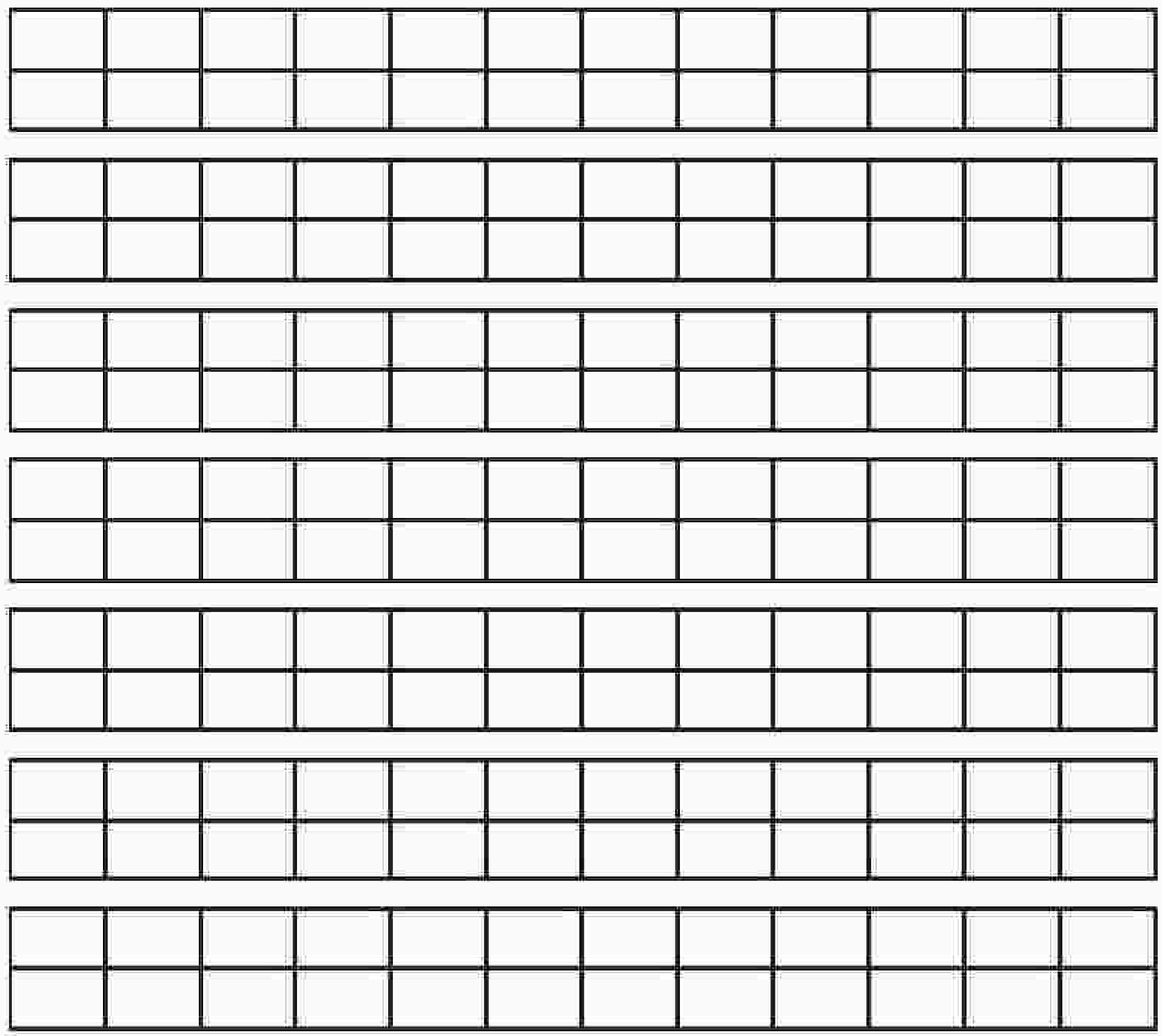


MTE_Egypt_TE_P4_T1_BLM.indd 23 22/07/21 11:33 AM

Unit 6, Lesson 1
Identifying Factors of Whole Numbers

24 Tiles

Instructions: Photocopy one set per student and cut tiles out along the black solid lines.



MTB_Egypt_TE_P4_T1_B.Ma.indd 24 22/07/21 11:34 AM

Unit 6, Lesson 1
Identifying Factors of Whole Numbers

Hundreds Chart

Instructions: Photocopy one Hundreds Chart per student.

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

MTB_Egypt_TE_P4_T1_BLM.indd 25 22/07/21 11:34 AM

Unit 6, Lesson 3
Greatest Common Factor

Math Fluency Sprint

Score ______

1. 3 × 2 = ______
2. 2 × 5 = ______
3. 1 × 7 = ______
4. 3 × 3 = ______
5. 5 × 4 = ______
6. 10 × 7 = ______
7. 4 × 2 = ______
8. 3 × 5 = ______
9. 10 × 1 = ______
10. 2 × 8 = ______
11. 4 × 6 = ______
12. 6 × 3 = ______
13. 3 × 7 = ______
14. 5 × 5 = ______
15. 9 × 3 = ______
16. 4 × 4 = ______
17. 5 × 6 = ______
18. 7 × 5 = ______
19. 3 × 4 = ______
20. 5 × 2 = ______
21. ______ × 3 = 21
22. 4 × ______ = 24
23. 32 = 8 × ______
24. 6 × 7 = ______
25. 11 × 5 = ______
26. 8 × 8 = ______
27. 9 × 4 = ______
28. 7 × 7 = ______
29. ______ × 6 = 36
30. 5 × ______ = 35
31. 8 × 7 = ______
32. 4 × 9 = ______
33. 5 × 6 = ______
34. 6 × 8 = ______
35. ______ × 9 = 45
36. 7 × ______ = 42
37. 8 × 7 = ______
38. 9 × 7 = ______
39. 6 × 5 = ______
40. 4 × 9 = ______

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Unit 6, Lesson 4
Identifying Multiples of Whole Numbers

Teacher Hundreds Chart

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

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Unit 6, Lesson 4
Identifying Multiples of Whole Numbers

Hundreds Charts for Multiples

Instructions: Photocopy one set of Hundreds Charts per student.

Multiples of 2

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 3

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 4

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 5

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

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Unit 6, Lesson 4
Identifying Multiples of Whole Numbers

Hundreds Charts for Multiples, *continued*

Instructions: Photocopy one set of Hundreds Charts per student.

Multiples of 6

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 7

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 8

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

Multiples of 9

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	29	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10

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Unit 6, Lesson 5
Common Multiples

Multiples Match

Instructions: Photocopy one page per pair of students.

Partner A

A1. 5	A2. 3	A3. 8
A4. 9	A5. 2	A6. 1
A7. 4	A8. 8	A9. 5

Partner B

B1. 2	B2. 4	B3. 2
B4. 3	B5. 6	B6. 9
B7. 5	B8. 4	B9. 3

Unit 6, Lesson 6
Relationship Between Factors and Multiples

Factors and Multiples Game Cards

Instructions: Photocopy one set per pair of students.

10	30	20
15	12	9
24	8	50

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Unit 7, Lesson 5
Review Connecting Strategies

Matching the Models Cards

Instructions: Photocopy one set of A, B, and C cards for each student.

Set A

A1

$$\begin{array}{r} {}^{2}17 \\ \times \quad 4 \\ \hline 68 \end{array}$$

A2

$$\begin{array}{r} {}^{1}62 \\ \times \quad 5 \\ \hline 310 \end{array}$$

A3

$$\begin{array}{r} \overset{2}{1},\overset{1}{5}23 \\ \times \quad 4 \\ \hline 6{,}092 \end{array}$$

A4

$$\begin{array}{r} 1\overset{2}{2}8 \\ \times \quad 3 \\ \hline 384 \end{array}$$

A5

$$\begin{array}{r} {}^{2}471 \\ \times \quad 3 \\ \hline 1{,}413 \end{array}$$

A6

$$\begin{array}{r} 5\overset{1}{3}5 \\ \times \quad 2 \\ \hline 1{,}070 \end{array}$$

A7

$$\begin{array}{r} 2,\overset{1}{7}\overset{1}{6}1 \\ \times \quad 2 \\ \hline 5{,}522 \end{array}$$

A8

$$\begin{array}{r} \overset{1}{2}\overset{1}{6}7 \\ \times \quad 2 \\ \hline 534 \end{array}$$

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Unit 7, Lesson 5
Review Connecting Strategies

Matching the Models Cards, *continued*

Instructions: Photocopy one set of A, B, and C cards for each student.

Set B

B1

$$\begin{array}{rl} 1{,}523 & \\ \times \quad 4 & \\ \hline 12 & (4 \times 3) \\ 80 & (4 \times 20) \\ 2{,}000 & (4 \times 500) \\ 4{,}000 & (4 \times 1{,}000) \end{array}$$

B2

$$\begin{array}{rl} 17 & \\ \times \quad 4 & \\ \hline 28 & (4 \times 7) \\ 40 & (4 \times 10) \end{array}$$

B3

$$\begin{array}{rl} 267 & \\ \times \quad 2 & \\ \hline 14 & (2 \times 7) \\ 120 & (2 \times 60) \\ 400 & (2 \times 200) \end{array}$$

B4

$$\begin{array}{rl} 471 & \\ \times \quad 3 & \\ \hline 3 & (3 \times 1) \\ 210 & (3 \times 70) \\ 1{,}200 & (3 \times 400) \end{array}$$

B5

$$\begin{array}{rl} 62 & \\ \times \quad 5 & \\ \hline 10 & (5 \times 2) \\ 300 & (5 \times 60) \end{array}$$

B6

$$\begin{array}{rl} 2{,}761 & \\ \times \quad 2 & \\ \hline 2 & (2 \times 1) \\ 120 & (2 \times 60) \\ 1{,}400 & 2 \times 700 \\ 4{,}000 & 2 \times 2{,}000 \end{array}$$

B7

$$\begin{array}{rl} 535 & \\ \times \quad 2 & \\ \hline 10 & (2 \times 5) \\ 60 & (2 \times 30) \\ 1{,}000 & (2 \times 500) \end{array}$$

B8

$$\begin{array}{rl} 128 & \\ \times \quad 3 & \\ \hline 24 & (3 \times 8) \\ 60 & (3 \times 20) \\ 300 & (3 \times 100) \end{array}$$

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Unit 7, Lesson 5
Review Connecting Strategies

Matching the Models Cards, *continued*

Instructions: Photocopy one set of A, B, and C cards for each student.

Set C

C1

	400	70	1
3	1,200	210	3

C2

	200	60	7
2	400	120	14

C3

	100	20	8
3	300	60	24

C4

	2,000	700	60	1
2	4,000	1,400	120	2

C5

	500	30	5
2	1,000	60	10

C6

	60	2
5	300	10

C7

	10	7
4	40	28

C8

	1,000	500	20	3
4	4,000	2,000	80	12

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Unit 7, Lesson 7
Area Models and 2-Digit Multiplication

Area Model Cards

Instructions: Photocopy one set of cards per student. Have students cut them apart.

20	10	2	7
30	9	4	10
2	70	10	15

20	10	2	7
30	9	4	10
2	70	10	15

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Unit 7, Lesson 9
Putting It All Together

Story Problem Cards

Instructions: Photocopy one card per student and cut apart the cards.

1. A salesperson has to drive 500 kilometers. For the first 3 hours, she drives 65 kilometers per hour. For the next 2 hours, she drives 55 kilometers per hour. How much does she have left to drive?
$65 \times 3 =$ _______ $55 \times 2 =$ _______ $500 -$ _______ $=$ _______
2. Seth drives for 2 hours and travels 500 kilometers. Maat drives for 3 hours and travels 430 kilometers. Adom also drives for 3 hours, but travels 55 fewer kilometers than Maat. How many kilometers do they drive in all?
$430 - 55 =$ _______ $500 + 430 +$ _______ $=$ _______
3. On Earth Day, workers planted 65 seedlings an hour. They worked for 3 hours then took a break. After their break, they worked another 2 hours but only planted 55 seedlings per hour. How many seedlings did they plant in all?
$65 \times 3 =$ _______ $55 \times 2 =$ _______ _______ $+$ _______ $=$ _______
4. There are about 27 car accidents per day in Egypt. The United States has about 62 times the number of car accidents per day. About how many accidents are there per week in the United States?
$27 \times 62 =$ _______ $7 \times$ _______ $=$ _______

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Unit 7, Lesson 9
Putting It All Together

Story Problem Cards, *continued*

Instructions: Photocopy and cut apart the cards.

5. Youssef reads 27 pages every night for a week. Aya reads 62 pages every night for a week. How many pages do they read in all?
27 × 7 = ________ 62 × 7 = ________ ________ + ________ = ________
6. There are 500 tickets available for the show. They sold 65 tickets on Monday and 55 tickets on Tuesday. How many tickets are left for the show?
65 + 55 = ________ 500 − ________ = ________
7. Ana is planning a bicycle race. One lap of the track is 126 kilometers long. The racers must make 3 laps around the track and then ride another 12 kilometers to the finish line. How long is the race in total?
126 × 3 = ________ ________ + 12 = ________
8. Yasmin bought 12 large sticker books. There were 96 stickers in each book. She gave 300 stickers away to her friends. How many stickers did she have left over?
96 × 12 = ________ ________ − 300 = ________

Unit 7, Lesson 11
Patterns and Place Value in Division

Number Cards

Instructions: Photocopy one set per pair of students.

6	7	8
9	10	11
12	13	14
15	16	17
18	19	20
21	22	23
24	25	

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Unit 7, Lesson 11
Patterns and Place Value in Division

Graph Paper

Instructions: Photocopy one sheet per student.

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Unit 7, Lesson 12
The Area Model and Division

Target Number Cards

Instructions: Photocopy and cut apart one set for each small group of students.

2	2	2	2
2	5	5	5
5	5	5	10
10	10	10	10
20	20	20	30
30	40	40	50

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Unit 7, Lesson 16

Solving Challenging Story Problems

Show and Solve Story Problems

Instructions: Photocopy or recreate the cards and cut them apart. Place them around the classroom.

1.	Mira bought 4 packs of pencils. There were 28 pencils in each of those packs. She also had 3 smaller packs of pencils at her house. There were 12 pencils in each of those. Mira wanted to bring all her pencils to school and give them to 4 of her friends. How many pencils will each friend get?
2.	Reem is stuffing envelopes. There are 1,500 envelopes. During the first hour, Reem stuffed 135 envelopes. During the second hour, she stuffs 141 envelopes. How many envelopes will Reem need to stuff in order to finish the job?
3.	Jasmine wants to organize her books from greatest number of pages to least number of pages. Jasmine's longest book has 396 pages. Her shortest book has 276 fewer pages than that. If the book in the middle of her shelf has three times the number of pages of the shortest book, then how many pages does the middle book have?
4.	Ahmed serves ice cream at a local ice cream shop. He sells 19 ice cream cones on Saturday, 27 ice cream cones on Sunday, and 153 ice cream cones for the entire week. How many ice cream cones did Ahmed sell on the weekdays?
5.	There are 1,421 tourists that visit the pyramids every weekend. How many tourists visit the pyramids in 8 weekends?

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Unit 7, Lesson 16
Solving Challenging Story Problems

Show and Solve Story Problems, *continued*

Instructions: Photocopy or recreate the cards and cut them apart. Place them around the classroom.

6.	A teacher bought 12 packs of crayons. Seven of the packs had 9 crayons in them. The other 5 had 10 crayons in each. How many crayons did the teacher buy in all?
7.	Ali discovered a buried treasure box. She opened it up and found that it contained 682 diamonds and 117 rubies. She sold 45 diamonds and bought 130 emeralds. How many gems does she have now?
8.	Four families went to the zoo. Each family has 2 adults and 2 children. Each child's ticket costs 14 LE and each adult's ticket costs 22 LE. How much will the zoo tickets cost in total?
9.	Sarah received 352 LE for her birthday. She found some toys that cost 8 LE each. How many of the toys could she buy?
10.	There are 164 people who play wind instruments and 20 people who play percussion in the band. If the band instructor puts 8 students in each row, how many rows will there be?

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Unit 8, Lesson 1
Problem-Solving Strategies

Information Gap Number Cards

Instructions: Photocopy the cards and distribute one card per student.

8	24	3	×
12	–	6	11
21	2	+	10
20	–	7	3
+	13	5	×
4	÷	16	18
9	÷	32	30

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Glossary

A

a.m.
A time between 12:00 midnight and 12:00 noon.

acute angle
An angle with a measure less than 90°.

acute triangle
A triangle with no angle measuring 90° or more.

add
To combine or join together; put together two or more quantities.

addend
Any number being added. In the equation 6 + 8 = 14, six and eight are both addends, 14 is the sum.

additive comparison
Problems that ask how much more (or less) one amount is than another.

Additive Identity Property of 0
When you add zero to a number, the sum is that same number.

algorithm
A step-by-step method for computing.

analyze
To study or examine something in detail.

angle
Two rays that share an endpoint.

angle measure
The measure of the size of an angle. It tells how far one side is turned from the other side. A one degree angle turns through $\frac{1}{360}$ of a full circle.

arc
Part of a circle's curve between any two of its points.

area
The measure, in square units, of the inside of a plane figure.

area model
A model of multiplication that shows each place value product.

array
An arrangement of objects in equal rows.

Associative Property of Addition
Changing the grouping of three or more addends does not change the sum.

Associative Property of Multiplication
Changing the grouping of three or more factors does not change the product.

attribute
A characteristic or property of an object, such as color, shape, size, and so on.

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Glossary

B

bar model
A model that uses bars to represent known and unknown quantities and the relationship between these quantities.

base
Any side of a plane figure. Usually thought of as a side where the figure "sits."

Base Ten numeral form
A common way of writing a number using digits. The value of a numeral depends on where it appears in the number (also known as standard form, such as 12,356).

Base Ten numerals
Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9. The symbols can represent any amount based on a place value system of grouping by tens (also known as digits).

benchmark
A known size or amount that can be used as a reference to help understand a different size or amount. A benchmark can be used to estimate measurement.

benchmark fractions
Fractions that are commonly used for estimation. A benchmark fraction helps you compare two fractions. One-half, one-third, one-fourth, three-fourths, and two-thirds are all benchmark fractions.

C

capacity
The amount of liquid a container can hold.

centimeter (cm)
A metric unit of length equal to 0.01 $\left(\frac{1}{100}\right)$ of a meter.

circle
A plane figure with all points the same distance from a fixed point called a center.

classify
To sort into categories or to arrange into groups by attributes.

clockwise
The same direction in which the hands on a clock move.

common
Belonging to or shared by.

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common denominator

For two or more fractions, a common denominator is a common multiple of the denominators. Three-fourths and two-fourths have four as a common denominator.

common factor

Any common factor of two or more numbers. Six is a common factor of both 12 and 24.

common multiple

Any common multiple of two or more numbers. Six is a common multiple of both 2 and 3.

common numerator

For two or more fractions, a common numerator is a common multiple of the numerators.

Commutative Property of Addition

Changing the order of the addends does not change the sum.

Commutative Property of Multiplication

Changing the order of the factors does not change the product.

compare

To decide if one number is greater than, less than, or equal to.

compatible numbers

Numbers that are easy to compute mentally and are close in value to the actual numbers. Compatible numbers can be used when estimating.

compose

To put together smaller numbers to make larger numbers.

composite number

A number greater than 0 that has more than two different factors.

congruent

Having exactly the same size and shape.

counterclockwise

The opposite direction from the direction that the hands move on a clock.

cup (c)

A customary unit of capacity.
1 cup = about 236.5 milliliters.

customary system

A system of measurement used in the United States. The system includes units for measuring length, capacity, and weight. Nearly everyone else uses the metric system.

D

data

A collection of information gathered for a purpose. Data may be in the form of either words or numbers.

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Glossary

day
The length of time it takes the Earth to make a complete rotation. 24 hours = 1 day.

decimal
A number with one or more digits to the right of a decimal point. In 7.46, forty-six hundredths is the decimal or fraction of the whole.

decimal fraction
A fractional number with a denominator of 10 or a power of 10. It can be written with a decimal point.

decimal notation
Uses digits 0–9 and a decimal point. For example: 23.56 is in decimal notation.

decimal point
A dot (.) separating the whole number from the fraction (parts) in decimal notation.

decimeter (dm)
A metric unit of length. 1 decimeter = 0.1 meter; 10 decimeters = 1 meter. A hand span is about 1 decimeter.

decompose
To separate a number into two or more parts.

degree (angle measure)
A unit for measuring angles. It is based on dividing one complete circle into 360 equal parts. A one degree angle = $\frac{1}{360}$ of a circle.

determine
To decide or settle upon, figure out.

denominator
The quantity below the line in a fraction. It tells how many equal parts are in the whole.

diagonal
A line that goes through vertices of a polygon that are not next to each other.

difference
The amount that remains after one quantity is subtracted from another. The answer in a subtraction problem.

display
To show, exhibit, or demonstrate.

digit
Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9. (Also known as Base Ten numerals.)

Distributive Property
When one of the factors of a product is a sum, multiplying each addend before adding does not change the product.

divide
To separate into equal groups and find the number in each group or the number of groups. 56 split into 8 equal groups equals seven in each group, 56 ÷ 8 = 7

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dividend

A number that is divided by another number. 56 is the dividend in the above example.

divisible

A number is divisible by another number if the quotient is a counting number without a remainder.

divisor

The number by which another number is divided. 8 is the divisor in $56 \div 8 = 7$.

E

elapsed time

The amount of time that has passed (also known as time interval). Six hours elapse between 8:00 am and 2:00 pm.

endpoint

A point at either end of a line segment, or a point at one end of a ray.

equal

Having the same value. 2 feet = 24 inches

equation

A mathematical sentence with an equal sign. The amount on one side of the equal sign has the same value as the amount on the other side. $4 + 3 = 7$

equivalent decimals

Decimals that have the same value. $0.7 = 0.70$

equivalent fractions

Fractions that have the same value. $\frac{1}{2} = \frac{2}{4}$

estimate

To find a number close to an exact amount; an estimate tells *about* how much or *about* how many.

expanded form

A way to write numbers that shows the place value of each digit. $263 = 200 + 60 + 3$

expression

A mathematical phrase without an equal sign. $n + 4$

F

fact family

A group of related facts that use the same numbers (also known as related facts). Fact family for 3, 5, 15: $3 \times 5 = 15$; $15 \div 5 = 3$; $5 \times 3 = 15$; $15 \div 3 = 5$

factors

The whole numbers that are multiplied to get a product. $6 \times 7 = 42$ (6 and 7 are factors.)

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Glossary

factor pairs

A set of two whole numbers that when multiplied will result in a given product. $2 \times 3 = 6, 1 \times 6 = 6$. The factor pairs for 6 are: 2 and 3, 1 and 6.

fluid ounce (fl oz)

A customary unit of capacity.
1 fluid ounce = about 30 milliliters.

foot (ft)

A customary unit of length.
1 foot = about 30 centimeters.

formula

A rule that is written as an equation. $A = l \times w$

fraction

A way to describe a part of a whole or a part of a group by using equal parts.

fraction greater than one

A fraction with the numerator greater than the denominator. $\frac{6}{5}$

fraction less than one

A fraction with the numerator less than the denominator. $\frac{5}{6}$

G

gallon (gal)

A customary unit of capacity. 1 gallon = about 3.8 liters.

gram (g)

The standard unit of mass in the metric system. 1,000 grams = 1 kilogram. The mass of a paperclip is about 1 gram.

greater than >

Used to compare two numbers when the first number is larger than the second number.

H

half gallon

A customary unit of capacity.
1 half gallon = about 1.9 liters.

height

A perpendicular line segment from the base to the top of the figure.

hexagon

A polygon with six sides.

horizontal

Parallel to the horizon. Horizontal lines go from left to right or right to left.

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hour (hr)
A unit of time. 1 hour = 60 minutes; 24 hours = 1 day.

Hundreds
The value of a digit that is the third position from the right when describing whole number place value.

hundredth
One of the equal parts when a whole is divided into 100 equal parts.

Hundredths
In the decimal numeration system, Hundredths is the name of the next place to the right of Tenths.

I

identify
Recognize or distinguish, figure out what it is, name it.

Identity Property of Multiplication
The property that states that the product of any number and 1 is that number: $n \times 1 = n$

inch (in)
A customary unit of length. 1 inch = about 2.5 centimeters.

intersecting lines
Lines that cross at a point.

inverse operations
Operations that undo each other. Multiplication and division are inverse operations. $8 \times 5 = 40$ and $40 \div 5 = 8$

interpret
To explain or tell the meaning of something.

J

justify
To show or prove to be right or reasonable.

K

kilogram (kg)
A metric unit of mass equal to 1,000 grams. 1 kilogram = about 2.2 pounds.

kilometer (km)
A metric unit of length equal to 1,000 meters.

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L

length
How long something is. The distance from one point to another. Length is measured in units such as centimeters, meters, and kilometers. One dimension of a 2-dimensional or 3-dimensional figure.

less than <
Used to compare two numbers when the first number is smaller than the second number.

like denominators
Denominators in two or more fractions that are the same.

like numerators
Numerators in two or more fractions that are the same.

line
A set of connected points continuing without end in both directions.

line of symmetry
A line that divides a figure into two congruent halves that are mirror images of each other.

line plot
A diagram showing frequency of data on a number line.

line segment
A part of a line with two endpoints.

line symmetric figures
Figures that can be folded in half and its two parts match exactly.

line symmetry
What a figure has if it can be folded in half and its two parts match exactly.

liter (L)
The basic unit of capacity in the metric system. 1 liter = 1,000 milliliters.

lowest terms
When a fraction is expressed with the fewest possible pieces, it is in lowest terms (also known as simplest form).

M

mass
The amount of matter in an object, usually measured by comparing with an object of known mass. While gravity influences weight, it does not affect mass.

mental math or mental calculation
Calculations that are done in a student's head without pencil and paper, calculators, or other aids.

meter (m)
A standard unit of length in the metric system.

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metric system
A system of measurement based on tens. The basic unit of capacity is the liter. The basic unit of length is the meter. The basic unit of mass is the gram.

mile (mi)
A customary unit of length. 1 mile = about 1.6 kilometers.

milliliter (mL)
A metric unit of capacity. 1,000 milliliters = 1 liter. This holds about 10 drops or 1 milliliter.

millimeter
A metric unit of length.
1,000 millimeters = 1 meter.

minute (min)
A unit used to measure a short amount of time. There are 60 minutes in one hour.

mixed number
A number that has a whole number and a fraction.

model or visual model
A picture or representation of a solution, a number, or a concept.

month
A length of time equal to 28, 30, or 31 days.
12 months = 1 year.

multidigit
Having more than one digit (number). Seven (7) is a single digit, whereas seventy-two (72) or seven hundred forty-two (742) are a multidigit numbers.

multiple
A product of a given whole number and any other whole number. 12 is a multiple of 3 and 4 because 3 × 4 = 12.

multiplicative comparison
A way to compare quantities using multiplication, as in "This tree is 3 times shorter than that tree."

multiply
The operation of repeated addition of the same number. 3 × 5 = 5 + 5 + 5

N

number
The quantity we associate with a numeral. Often used interchangeably with digit and numeral.

number line
A diagram that represents numbers as points on a line.

number names
A way of using words to write a number (also known as word form).

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Glossary

numeral
Represents the idea of a number. The numeral 153 is composed of digits 1, 5, and 3. Often used interchangeably with digit and number.

numerator
The number written above the line in a fraction. It tells how many equal parts are described in the fraction.

O

obtuse angle
An angle with a measure greater than 90° but less than 180°.

obtuse triangle
A triangle that contains one angle with a measure greater than 90° (obtuse angle) and two acute angles.

Ones
The value of a digit that is farthest to the right when describing whole number place value.

order
A sequence or arrangement of things.

Order of Operations
A set of rules that tells the order in which to compute.
1. Do operations in parentheses.
2. Multiply and divide in order from left to right.
3. Add and subtract in order from left to right.

ounce (oz)
A customary unit of weight equal to $\frac{1}{16}$ of a pound. 1 ounce = about 28 grams.

P

p.m.
The time between 12:00 noon and 12:00 midnight.

parallel lines
Lines that are always the same distance apart. They do not intersect.

parallelogram
A quadrilateral with two pairs of parallel and congruent sides.

parentheses
Used in mathematics as grouping symbols for operations. When simplifying an expression, the operations within the parentheses are performed first.

partial product
A method of multiplying in which the value of each digit in a factor is multiplied separately, and then the partial products are added together.

partial quotient
A method of dividing in which multiples of the divisor are subtracted from the dividend, and then the partial quotients are added together.

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pattern
A repeating or growing sequence or design. An ordered set of numbers or shapes arranged according to a rule.

perimeter
The distance around the outside of a figure.

period
In a large number, periods are groups of 3 digits separated by commas or by spaces.

perpendicular lines
Two intersecting lines that form right angles.

pint (pt)
A customary unit of capacity.
1 pint = about 0.47 liters.

place value
The value of the place of a digit in a number.

plane figure
A two-dimensional figure.

point
The exact location in space, represented by a dot.

polygon
A closed two-dimensional shape with 3 or more sides.

pound
A customary unit of weight.
1 pound = about 0.45 kilograms.

prime number
A whole number greater than 1 that has exactly two different factors, 1 and itself.

product
The answer to a multiplication problem.
In $6 \times 7 = 42$, 42 is the product/answer.

protractor
A tool used to measure and draw angles.

Q

quadrilateral
A polygon with four sides.

quart (qt)
A customary unit of capacity. 1 quart = about 1 liter.

quotient
The answer to a division problem.

R

range
The difference between the highest and lowest values.

ray
A part of a line that has one endpoint and goes on forever in one direction.

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Glossary

reasonableness
An answer that is based on good number sense.

rectangle
A quadrilateral with two pairs of congruent, parallel sides and four equal angles.

recognize
Identify (someone or something) from having encountered them before; know again, remember.

regroup
To rearrange numbers into groups of 10 when performing mathematical operations.

regular polygon
A polygon with all sides the same length and all angles the same measure.

related facts (fact family)
Related addition and subtraction facts or related multiplication and division facts. Related facts for 3, 5, 8: 3 + 5 = 8; 8 – 5 = 3; 5 + 3 = 8; 8 – 3 = 5 (also known as fact family).

remainder
The amount left over when one number is divided by another.

repeated subtraction
Subtracting equal groups to find the total amount of groups (also called division).

represent
To show or model.

rhombus
A quadrilateral with all four sides equal in length.

right angle
An angle that measures exactly 90º.

right triangle
A triangle that has one 90º angle.

round a whole number
To identify the nearest Ten, Hundred, Thousand, (and so on) and rename a number so it is easier to mentally add, subtract, multiply, or divide.

rule
Something that happens every time (for example: 2, 5, 8, 11 . . . the rule is +3).

S

second (sec)
A unit used to measure a very short amount of time. There are 60 seconds in one minute.

sequence
A set of numbers arranged in a special order or pattern.

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simplest form

When a fraction is expressed with the fewest possible pieces, it is in simplest form (also known as lowest terms).

simplify

To express a fraction in simplest form.

sketch

A quick, rough drawing.

specify

Identify clearly and definitely.

square

A parallelogram with four equal angles and four equal sides.

square unit

A unit, such as square centimeter, used to measure area.

standard form

A common or usual way of writing a number using digits. 12,376 is in standard form.

straight angle

An angle that measures exactly 180°.

subtract

An operation that gives the difference between two numbers. Subtraction can be used to compare two numbers, or to find out how much is left after some is taken away.

sum

The answer to an addition problem.

T

Tens

The value of a digit that is the second position from the right when describing whole number place value.

tenth

One of the equal parts when a whole is divided into 10 equal parts.

Tenths

In the decimal numeration, tenths is the name of the place to the right of the decimal point.

Thousands

The value of a digit that is the fourth position from the right when describing whole number place value.

time interval

A duration of a segment of time (also known as elapsed time).

ton

A customary unit of weight. 1 ton (T) = 2,000 pounds. A metric ton, or tonne (t) is a unit of mass equal to 1,000 kilograms (about 2,200 pounds).

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Glossary

trapezium
A quadrilateral with one pair of parallel sides and one pair of sides that are not parallel.

triangle
A polygon with three sides and three angles.

two-dimensional
Having length and width.

U

unit fraction
A fraction that has 1 as its numerator. A unit fraction names 1 equal part of a whole.

unlike denominators
Bottom numbers of a fraction that are not equal.

unlike numerators
Top numbers of a fraction that are not equal.

V

variable
A letter or symbol that represents a number. $5 \times b = 10$, *b* is a variable worth 2.

Venn diagram
A drawing with circles or rings to show how sets of objects are related.

vertex (plural: vertices)
The point at which two line segments, lines, or rays meet to form an angle.

vertical
Perpendicular to the horizon. Vertical lines go up and down.

volume
The number of cubic units it takes to fill a figure.

W

week
There are seven days in a week: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday.

weight
The measure of how heavy something is.

whole
All of an object, a group of objects, shape, or quantity.

whole numbers
The numbers 0, 1, 2, 3, and so on, without fractions or decimals.

width
One dimension of a 2-dimensional or 3-dimensional figure.

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word form

A way of using words to write a number. The word form of 12,345 is twelve thousand, three hundred forty-five.

Y

yard (yd)

A customary unit of length. 1 yard = about 0.9 meters.

year

The length of time it takes the Earth to revolve around the sun. 12 months = 1 year;
365 days = 1 year; 366 days = 1 leap year.

Z

Zero Property of Multiplication

The product of any number and zero is zero.
$8 \times 0 = 0$

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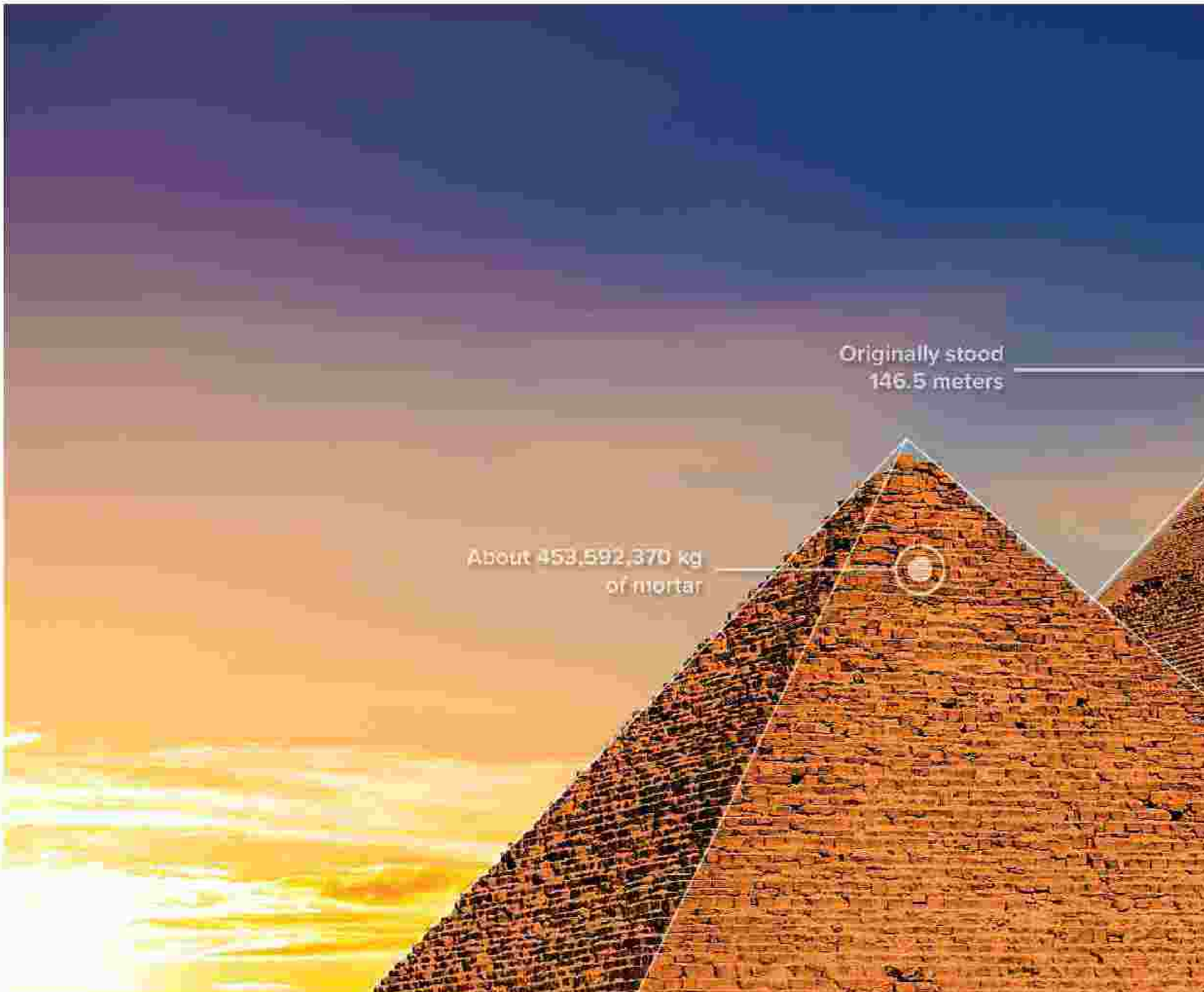
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